

Oil resources: the key to prosperity or to poverty?

Influence of oil price shocks on spending of oil revenues

Olga Selivanova



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Preface

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1. Introduction

Abundant natural resources play an important role in influencing national economics and international economic relations. The availability of mineral resources, first of all oil and gas, affects economic development in oil- and gas-exporting countries and serves as a source of accumulation of national wealth and economic growth. But at the same time, as history shows, economic prosperity doesn't necessarily need availability of natural riches. For example, such progressive countries as Japan, Hong Kong, the Republic of Korea or Singapore are resource poor but it doesn't keep them away from being among the world's richest economies. Among developed countries, for instance, the United Kingdom and the United States have nowadays a very small share of natural capital in the national wealth as well.

However, few resource-rich developing countries managed to preserve reaped economic gains from the mineral resource discovery and to sustain acceptable economic growth. The exceptions are Botswana, Chile and Oman. To the contrary Sierra Leone, Bolivia, Nigeria and Zambia have experienced serious destructive influence of resource abundance and are among poorest countries in the world.

So how should government spend oil revenues to sustain and stimulate economic growth, to support socio-economical development and to accumulate wealth? Which challenges do resource-rich countries experience? Is it possible to use natural resources without hurting national welfare? All these questions are important in investigation the influence of oil windfalls on national economies.

Different indicators can be used to describe the country's resource dependence, for example the share of oil exports in gross domestic product (GDP), the share of oil exports in total exports or the share of natural capital in total capital. It is useful to look at the relations between the share of natural capital in total capital, for instance, and the rate of annual GDP growth to find out the groups of countries that are resource poor but have decent economic growth and that are resource rich but have low economic growth. Numerous multiple regression analyses with different determinants of economic growth have been conducted to reveal the negative relations between government oil revenues and the rate of economic growth.

The key to understand the difference between high- and low-performing economies is to look at the spending of the oil windfalls. Oil price shocks happened often for the last forty years when oil started to play an important role in the economies of countries that found it. The reaction to these shocks defined their future making some countries prosperous and some even poorer than they had been before. So the question that arises naturally is how to handle oil revenues to make country “blessed” by oil abundance and what is the optimal way to spend oil income. Is it a right way to spend the entire windfall right now or to invest money in domestic or foreign assets? Some countries as Nigeria and Mexico used oil revenues heavily on current spending and carried large investments projects but it didn’t help them to reach long-term success. However there were certain reasons that pushed them to follow this strategy. In contrast Norway didn’t follow their way and chose its own behaviour of saving almost all oil revenues that helped to sustain the country’s economy during the crisis in the beginning of 1990s and to achieve social welfare. However the starting points for mentioned countries were quite different so it is countries’ specific features that define the development strategy such as oil reserves, oil production, political regime, the presence of rent seeking, trust of population to the government, the government aim to have fair distribution of oil revenues among the generations, i.e. the complex of economic, political and social reasons.

Savings of oil revenues are done by establishment of oil funds in many countries. There are “stabilization funds” helping government to cope with the volatility and unpredictability of oil prices and hence oil revenues, and “saving funds” dealing with intertemporal perspective of saving oil revenues for the future. But oil funds have their own bundle of problems related to the integration of oil funds into the budget, complications of fiscal policy and the management of public assets and liabilities.

The plan of the thesis is the following: first there is a theoretical chapter that contains an intertemporal optimization model of national wealth. It tells about what optimal consumption path of natural resources should be and how temporary and permanent shocks influence it. Besides there are examples of optimal spending rate under different shocks and an example of establishment of a hypothetical petroleum fund. The next chapter narrates about four leading oil exporters (Saudi Arabia, Nigeria, Mexico and Norway) in historical perspective. The influence of oil on the economies of these countries is discussed. The

following chapter holds comparison of four oil exporters, namely their reaction to four main oil price shocks that happened in 1973-74, 1979-80, 1986 and 2003-2004.

The data necessary to analyse the historical background and make comparison of oil exporters such as oil prices, total oil production, public finances and current account deficits for 1970-2006 are available on-line through the web-page of The British Petroleum (<http://www.bp.com>), OECD (<http://www.oecd.org>), OPEC (<http://www.opec.org>), the World Bank statistics (<http://www.worldbank.org>) and national statistics bureaus (www.sama.gov.sa, www.cenbank.org, www.nigerianstat.gov.ng, www.banxico.org.mx, www.ssb.no).

2. An intertemporal optimization model of national wealth

There are two fundamental methods of looking to the perspective of optimisation. The first one is individual perspective presented by the descriptive models of any economy where private consumers are optimising the use of their own resources. The second approach, which is considered here, is the social planner perspective presented by the normative models where the whole government's act is optimised over time. In our case the government, or social planner, decides how oil revenues should be spent and distributed fairly between generations.

In that way the purpose of this chapter is to figure out government's behaviour in the stochastic settings that are inherent to consumption and investment decision-making and to analyze the influence of the temporary and permanent shocks in the form of oil price changes on the optimal consumption path. The stochastic settings are chosen because the assumption of perfect foresight is far from being realistic one: people can not foresee all temporary shocks that can happen to economy. "A stochastic current account model" from Obstfeld and Rogoff (1996) and "An intertemporal optimization model of national wealth" from Bjerkholt, Olsen Vislie (1990) are taken as the basis.

Another assumption is rational expectations. Decisions today are based on the information that we have received lately but our expectations should be revised as we receive new information about future. Mathematically a rational expectation is a conditional expectation based on an accurate model of the economy's structure and on all the information about current economic variables that the individual has available¹. The advantages of using rational expectations are that rational forecasts are unbiased, i.e. on average correct, and that rational forecast errors are uncorrelated with the information on which the forecast was conditioned. Besides rational expectations help to avoid a warning that says that pure extrapolation of past into the future is dangerous (the Lucas critique). A macro model with backward-looking expectations can not be used to predict future behaviour if a policy regime has changed because this change will influence the formation of expectations as well.

¹ Obstfeld, Rogoff (1996)

The model presented here is designed for a small open economy with government whose horizon of planning is infinite. A “small” economy means that it always faces a fixed world interest rate and can’t unilaterally influence it. The assumption about infinite horizon is justified by two reasons. The first one is that the terminal date is uncertain. Good social planner is interested not only in its current wealth, consumption etc. but also in the prosperity of all future generations of the country that form the sequence of finite-lived individuals. So then it is justified the using of infinite horizon. The second reason is the following: saying that there is an infinite horizon in the model is the same as saying that the terminal date is quite distant². So factually an infinite horizon is the same as a finite horizon but just very remote.

The concept of national wealth is meant to represent future consumption possibilities. The national wealth consists of four elements: natural resources (petroleum), real capital, human capital and net foreign debt.

The government taking into account uncertainty maximises the expected discounted value of utility function subject to the wealth constraint; the problem is to find the optimal consumption path. Hence the model represents an intertemporal choice between present consumption and formation of the national wealth. The management of the national wealth solves the question whether to consume income from petroleum production and production of other goods and services today or to make investments for future consumption.

The formal model has the following form:

$$\max_{C_s} E_t \left\{ \sum_{s=t}^{\infty} U(C_s) \theta^{s-t} \right\} \quad (1)$$

subject to

$$\sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} (C_s + I_s) = (1+r)B_t + \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} (Y_s + P_s x_s) \quad (2)$$

where C_s is total consumption;

² If T is the terminal date, then it could be stated that $T \rightarrow \infty$.

$U(C_s)$ is the utility of consumption;

$\theta = \frac{1}{1+\delta}$, δ is the subjective discount rate;

B_s is foreign riskless bonds;

I_s is investment in real capital during period s ;

r is the real rate of return of foreign bonds;

Y_s is production of other goods than petroleum;

P_s is price of petroleum;

x_s is petroleum production.

The exogenous variables are the subjective discount rate δ and hence θ , the rate of return of foreign bonds r and price of petroleum at the period t P_t . Investment I_s as a first-time approximation is also given independently. Maximisation of the expected value of lifetime utility function is taken with respect to consumption C_s .

It is assumed that consumption decisions and investment decisions can be separated. So investments in the real capital are independent of oil prices and hence oil revenues. In the small open economy where world interest rate is exogenously given social planner buys capital in the world market until marginal productivity of capital is equal to that interest rate. In our case government will do it all the time irrespective of oil revenues.

So the decision about whether to invest at home or to lend abroad should be independent of oil prices. Besides in practice government often doesn't look at the return of investments: it has other rational reasons, for example political ones, when it considers where to invest.

If $\delta < r$, i.e. the subjective discount rate is smaller than the rate of return of foreign bonds, then the country will have a growing consumption path; if $\delta > r$, i.e. the subjective discount rate is higher than the rate of return of foreign bonds, then country will have a decreasing consumption path. Only when it happens that $\delta = r$, then country will have path with constant consumption that will be optimal, i.e. consumption will follow a trendless long-run

path. On the one hand, this is the knife-edge behaviour because at $\delta = r$ consumption will be constant. On the other hand, we are making this simplifying assumption just to focus on the effects of spending oil revenues but not to concentrate on consumption and income growth.

The wealth constraint consists of riskless foreign bonds and petroleum wealth. Only riskless foreign bonds are considered because if other assets with risky payoffs were included in the analysis, it would influence model's dynamics. $P_s x_s$ represents the net oil revenues as the costs of oil production are disregarded.

Using period by period the intertemporal budget constraint (2) helps to eliminate consumption levels from the maximised expected discounted utility function, turning the consumer's problem into the unconstrained one with respect to the sequence of contingency plans for riskless foreign bonds³:

$$\max_{C_s} E_t \left\{ \sum_{s=t}^{\infty} U((1+r)B_{s-1} + Y_s + P_s x_s - B_s - I_s) \theta^{s-t} \right\}$$

Then the first order condition with respect to B_s has the following form:

$$E_t \{U'(C_s)\} = (1+r)\theta E_t \{U'(C_{s+1})\}. \quad (3)$$

If $s = t$ then equation (3) turns to:

$$U'(C_t) = (1+r)E_t \{\theta U'(C_{t+1})\}. \quad (4)$$

Equation (4) is the intertemporal consumption Euler equation that shows that at a utility maximum the consumer can't gain from feasible shifts of consumption between periods.

The solution of the model helps to find the optimal consumption under uncertain income where the uncertainty of oil revenues can be represented by the probability distribution of oil prices.

First we shall consider the utility functions with quadratic preferences and after with non-quadratic preferences.

³ Obstfeld, Rogoff (1996)

2.1 Quadratic form of utility function

The utility function for consumption takes the following form of deviation from the target optimal value \bar{C} which is a bliss point:

$$U(C_t) = -\frac{1}{2}(C_t - \bar{C})^2$$

$$U'(C_t) = -(C_t - \bar{C}) \geq 0 \quad \text{if} \quad C_t \leq \bar{C}.$$

The closer consumption is to the target value, the more an individual is risk averse. In other words, he/she is less willing to undertake more risky project, the higher is the already attained level of consumption. This is the disadvantage of using utility functions with quadratic preference as it is empirically more reasonable to assume that the risk aversion decreases or is constant as higher consumption levels are reached⁴.

The quadratic utility function allows finding optimal consumption path. To do this equation (3) should be combined with equation (2). The special assumption that subjective discount rate equals to the rate of return of foreign bonds $\delta = r$ gives the following

result $(1+r)\theta = (1+r)\frac{1}{1+\delta} = 1$. Substituting marginal utility that is linear in consumption into equation (4) we have:

$$C_t = E_t\{C_{t+1}\}. \quad (5)$$

Hence it means that consumption follows a random walk. The intertemporal budget constraint (2) holds with probability one (no Ponzi game is allowed), thus the application of mathematical expectation doesn't violate equation (2):

$$E_t \left\{ \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} (C_s + I_s) \right\} = E_t \left\{ (1+r)B_t + \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} (Y_s + P_s x_s) \right\}. \quad (6)$$

⁴ Bjerkholt, Olsen and Vislie (1990)

The Euler equation (3) implies in the case of quadratic utility function for $s > t$ that

$E_t C_s = E_t C_{s-1} = E_t C_{s-2} = \dots = E_t C_{t+1} = C_t$. Substituting it to the equation (6) and rearranging the terms we get:

$$\sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} C_s = E_t \left\{ (1+r)B_t + \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} (Y_s + P_s x_s - I_s) \right\}. \quad (7)$$

Then the solution for the optimal consumption path has the following form:

$$C_t = \frac{r}{1+r} \left\{ (1+r)B_t + \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} E_t (Y_s + P_s x_s - I_s) \right\}. \quad (8)$$

Oil revenues influence the optimal consumption path in the following way: the higher oil prices are, the higher is the optimal consumption level. Higher production of other goods and higher investments in foreign riskless bonds influence also positively on the optimal consumption level. The effect of investment in the real capital can be both positive and negative because investment decreases directly the optimal consumption level but at the same time it has indirect positive effect: investment affects production of other goods positively which in its turn has positive influence on consumption.

2.1.1 Temporary oil price shock

Using static expectations we can introduce temporary price shock which impact depends on the time profile of the petroleum production. As examples of the temporary shock it can be mentioned revolution in Iran or problems with the oil pipelines built on the territory of countries that are not oil-exporters.

Here it is assumed that today's oil price doesn't influence expectations about the oil price tomorrow, i.e. that oil prices are independently distributed. Hence the oil price in period s , $s > t$, is given by:

$$P_s = \pi + \varepsilon_s; \quad E_t(P_s) = \pi, \quad \text{var}(P_s) = \tau_s^2,$$

where π is expected oil price which is constant;

ε_s is a serially uncorrelated disturbance, ε_t is known at t , $E_t \varepsilon_s = 0 \quad s > t$; $\text{var}(\varepsilon_s) = \tau_s^2$.

Here the shock is temporary and that is why it doesn't influence the following oil price formation and expected oil price.

Rewriting equation (8) and assuming that x_s is non-stochastic we get:

$$C_t = rB_t + \frac{r}{1+r} \left\{ \sum_{s=t}^{\infty} E_t \left(\frac{1}{1+r} \right)^{s-t} (Y_s - I_s) \right\} + \frac{r}{1+r} \left\{ \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} E_t ((\pi + \varepsilon_s) x_s) \right\}$$

We can simplify the previous expression by defining $\bar{Y}_t = \frac{r}{1+r} \left\{ \sum_{s=t}^{\infty} E_t \left(\frac{1}{1+r} \right)^{s-t} (Y_s - I_s) \right\}$

and $\bar{x}_t = \frac{r}{1+r} \left\{ \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} x_s \right\}$. So we get:

$$C_t = rB_t + \bar{Y}_t + \pi \bar{x}_t + \frac{r}{1+r} \varepsilon_t x_t \quad (9)$$

The variance of the oil price τ_s^2 is not a parameter in the optimal solution so it doesn't influence the optimal consumption.

Equation (9) shows that the higher is the expected oil price, the higher is the optimal consumption level. In the case of uncertainty and assumption about certainty equivalence⁵ as here the social planner spends $\frac{r}{1+r}$ from this year's additional income. So the temporary oil price shock will influence the present level of oil revenues and hence the present level of consumption. Besides it will also change the future levels of consumption. Namely, since the social planner increase savings through B_t future consumption will increase.

Moreover we see the importance of production profile x_s . It is different for various countries and it will affect consumption today. The higher is expected average of oil production, the higher will be optimal path of consumption.

⁵ The social planner makes decision under uncertainty as if expected values were certain to be realized.

2.1.2 Permanent oil price shock

Suppose that we have a permanent oil price shock and oil prices follow random walk:

$$P_{s+1} = P_s + \varepsilon_{s+1} \quad (10)$$

where ε_{s+1} is a serially uncorrelated disturbance, $E_t \varepsilon_{s+1} = 0 \quad s \geq t$.

So here we have permanent oil price shock which can be represented by for example larger Chinese consumption of the oil. So the price shock in period s influence the whole sequence of prices, namely if this is a positive price shock, then the following oil prices will increase proportionally.

Calculating expectations from equation (10) we get that $E_t P_s = P_t$ for $s = t, t+1, t+2, \dots$. So the oil price today is the best predictor for oil price tomorrow.

Hence equation (8) becomes as following one:

$$C_t = rB_t + \bar{Y}_t + P_t \bar{x}_t = rB_t + \bar{Y}_t + (P_{t-1} + \varepsilon_t) \bar{x}_t \quad (11)$$

So the higher is the oil price shock, the higher is the optimal consumption level. Here the oil price shock influences not just the current level of consumption but also the future ones. If we have positive shock in period t , it will penetrate proportionally into period s increasing present and future consumption levels. For example, for period $s+2$ we have $P_{s+2} = P_{s+1} + \varepsilon_{s+2} = P_s + \varepsilon_{s+1} + \varepsilon_{s+2}$, i.e. the shock in period $s+1$ is additively added to the shock in period $s+2$. Taking expectations we get: $E_t P_{s+2} = P_{s+1} = P_s + \varepsilon_{s+1}$. So equation (11) transforms to $C_{s+2} = rB_{s+2} + \bar{Y}_{s+2} + E_t (P_{s+2}) \bar{x}_{s+2} = rB_{s+2} + \bar{Y}_{s+2} + (P_s + \varepsilon_{s+1}) \bar{x}_{s+2}$. The social planner consumes $\varepsilon_{s+1} \bar{x}_{s+2}$ of the additional income in the year $s+2$. Hence the shock in previous periods influences the consumption level in the next period and previous savings define the following level of consumption.

If oil prices have a multiplicative shock and follow random walk with the trend equal to the rate of return of foreign bonds⁶, then the oil price in period s is defined as:

$$P_{s+1} = P_s(1+r) \cdot \varepsilon_{s+1} \quad s \geq t \quad (12)$$

It is assumed that $E_t(\varepsilon_{s+1}) = 1$; $\text{var}(\varepsilon_{s+1}) = \sigma^2$. Hence $E_t P_s = P_t(1+r)^{s-t}$.

Rewriting (8) and defining that $X_t = \left\{ \sum_{s=t}^{\infty} x_s \right\}$ ⁷ we have:

$$\begin{aligned} C_t &= rB_t + \frac{r}{1+r} \left\{ \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} E_t(Y_s - I_s) \right\} + \frac{r}{1+r} \left\{ \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} E_t(P_s(1+r)^{s-t} \varepsilon_s x_s) \right\} \\ &= rB_t + \bar{Y}_t + \frac{r}{1+r} \left\{ \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} P_t(1+r)^{s-t} x_s \right\} = rB_t + \bar{Y}_t + \frac{r}{1+r} P_t \left\{ \sum_{s=t}^{\infty} x_s \right\} = rB_t + \bar{Y}_t + \frac{r}{1+r} P_t X_t \\ &= rB_t + \bar{Y}_t + \frac{r}{1+r} (P_{t-1}(1+r)\varepsilon_t) X_t = rB_t + \bar{Y}_t + rP_{t-1}\varepsilon_t X_t \end{aligned} \quad (13)$$

So the oil price shock acts multiplicatively through the rate of foreign bonds. In comparison with the previous case where we had additive permanent shock, here the influence of the shock on the future levels of consumption will be multiplicative and propagates with the rate of return of foreign bonds. For example if we have an expected future shock in period

$s+1$ $P_{s+1} = P_s(1+r) \cdot \varepsilon_{s+1}$, then taking into account that

$$E_t P_{s+2} = E_t (P_{s+1}(1+r) \cdot \varepsilon_{s+2}) = P_{s+1}(1+r) = P_s(1+r)^2 \varepsilon_{s+1} \text{ the consumption level in period } s+2$$

will be: $C_{s+2} = rB_{s+2} + \bar{Y}_{s+2} + \frac{r}{1+r} (P_s(1+r)^2 \varepsilon_{s+1}) X_s = rB_{s+2} + \bar{Y}_{s+2} + r(P_s(1+r)\varepsilon_{s+1}) X_s$.

Hence in period $s+2$ the social planner consumes additional income from the shock equal to $rP_s(1+r)\varepsilon_{s+1} X_s$ and has accumulated savings B_{s+2} . So consumption in later periods depends on previous savings (for example B_t), which are influenced by the shocks.

⁶ Hotelling's theory of the market for exhaustible resources which says that the resource rent increases by the rate of interest r makes this case interesting.

⁷ Comparing X_t with \bar{X}_t , the first one is just the accumulated oil reserves and the second one is the discounted accumulated oil reserves.

Let's consider the general case which earlier cases are special cases of:

$$P_{s+1} - \pi = \rho(P_s - \pi) + \varepsilon_{s+1}, \quad (14)$$

where π is long-run equilibrium price;

$$E_t \varepsilon_s = 0 \text{ for } s > t;$$

$0 \leq \rho \leq 1$, what means that deviation of oil price in period $s+1$ decreases in comparison with deviation of oil price in period s .

Here we have two types of shocks – both temporary and permanent, and the degree of permanence of shock is determined by ρ .

This hypothesis imply that

$$E_t(P_s - \pi) = \rho^{s-t}(P_t - \pi). \quad (15)$$

Hence equation (8) can be rewritten in the following way:

$$\begin{aligned} C_t &= rB_t + \bar{Y}_t + \frac{r}{1+r} \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} E_t(P_s - \pi + \pi)x_s = rB_t + \bar{Y}_t + \frac{r}{1+r} \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} [\rho^{s-t}(P_t - \pi) + \pi]x_s \\ &= rB_t + \bar{Y}_t + \frac{r}{1+r} \sum_{s=t}^{\infty} \left(\frac{\rho}{1+r} \right)^{s-t} (P_t - \pi)x_s + \frac{r}{1+r} \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} \pi x_s \quad (16) \end{aligned}$$

Substituting $P_t - \pi$ in (16) we have:

$$\begin{aligned} C_t &= rB_t + \bar{Y}_t + \frac{r}{1+r} \sum_{s=t}^{\infty} \left(\frac{\rho}{1+r} \right)^{s-t} \rho(P_{t-1} - \pi + \varepsilon_t)x_s + \frac{r}{1+r} \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} \pi x_s \\ &= rB_t + \bar{Y}_t + \frac{r}{1+r} \rho \sum_{s=t}^{\infty} \left(\frac{\rho}{1+r} \right)^{s-t} (P_{t-1} - \pi)x_s + \frac{r}{1+r} \rho \varepsilon_t \sum_{s=t}^{\infty} \left(\frac{\rho}{1+r} \right)^{s-t} x_s + \frac{r}{1+r} \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} \pi x_s \quad (17) \end{aligned}$$

Hence if the shock is positive and temporary ($\rho < 1$) and if the social planner pursues consumption-smoothing behaviour through asset accumulation, the optimal consumption

path will rise but not fully in the response of the shock because $\frac{r}{1+r}\rho < 1$. If the shock is permanent ($\rho = 1$), then $\frac{r}{1+r}\rho = \frac{r}{1+r}$ and

$$\begin{aligned} C_t &= rB_t + \bar{Y}_t + \frac{r}{1+r} \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} (P_{t-1} - \pi)x_s + \frac{r}{1+r} \varepsilon_t \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} x_s + \frac{r}{1+r} \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} \pi x_s \\ &= rB_t + \bar{Y}_t + \frac{r}{1+r} \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} (P_{t-1} - \pi)x_s + \varepsilon_t \bar{x}_t + \pi \bar{x}_t \quad (18) \end{aligned}$$

Hence the social planner increases the present consumption level if the shock is positive. As in the case of the permanent multiplicative shock the oil price shock today influences the future consumption level as well, and the larger is ρ , the degree of permanence of the shock, the more long-lasting is the shock and higher is the future level of consumption.

2.2 Optimal spending rate⁸

Let's try to find the optimal spending rate for three cases and compare them. Optimal spending rate is defined as ratio of consumption of oil revenues to current oil revenues, in other words it shows how much extra oil revenue is spent (consumed) due to the change of oil price. Let's start with the case for permanent multiplicative oil price shock (see equation (13)). Then the optimal spending rate looks like:

$$\frac{\frac{r}{1+r} P_t X_t}{P_t x_t} = \frac{\frac{r}{1+r} \left\{ \sum_{s=t}^{\infty} x_s \right\}}{x_t} \quad (19)$$

where r is international real interest rate;

x_s in numerator is expected oil production in year s ;

x_t in denominator is oil production in year t (today).

Hence the numerator represents permanent income that corresponds to the possibility of oil revenues and the denominator represents the current income from oil production. In other words the optimal spending rate shows the ratio between expected effect of oil price on future oil revenues and current oil revenues.

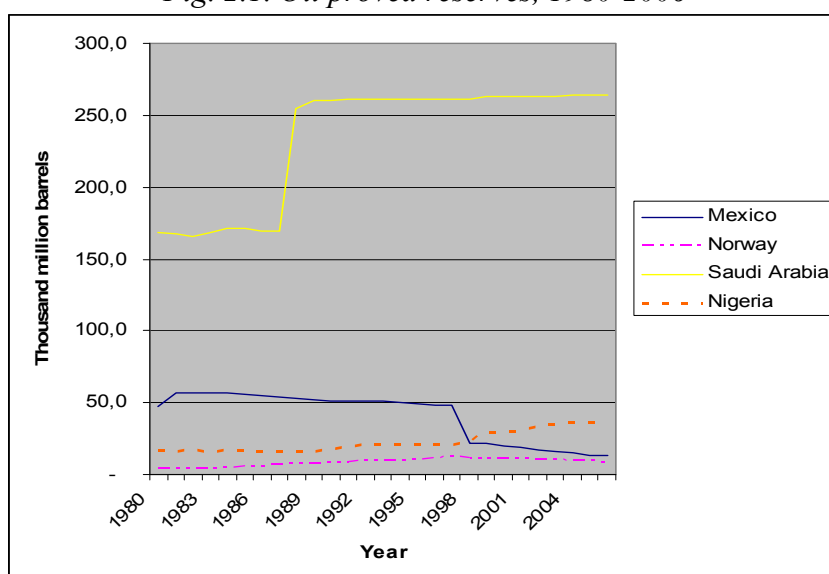
⁸ By "spending" it is meant just "consumption" here not including investment.

Using the statistics from BP Statistical Review of World Energy June 2007 (see *Table 1*, *Table 2* in Appendix), the following pattern of oil proved reserves and oil production are depicted on *Figure 2.1* and *Figure 2.2* for Norway, Mexico, Saudi Arabia and Nigeria.

The international real interest rate r is calculated as an average of interest rates for 30-year U.S. Treasury Bonds, issued from 1980 to 2006⁹, minus average inflation rate for U.S. from 1980 to 2006¹⁰, and is equal to 3,96 percent. To calculate the average optimal spending rate the value of the oil proved reserves represented by accumulating flow is taken for 2006¹¹ and then discounted according to the formula (19), and production is taken as average for the whole period 1980-2006.

Then the following results were achieved for optimal consumption rate (see *Figure 2.3*). We see that Saudi Arabia has the largest optimal spending rate equal to 3,36. On the second place is Nigeria with the optimal spending rate equal to 1,97. On the third place is Mexico with the optimal spending rate equal to 0,43 and then the forth place is taken by Norway with the optimal spending rate equal to 0,42.

Fig. 2.1. Oil proved reserves, 1980-2006

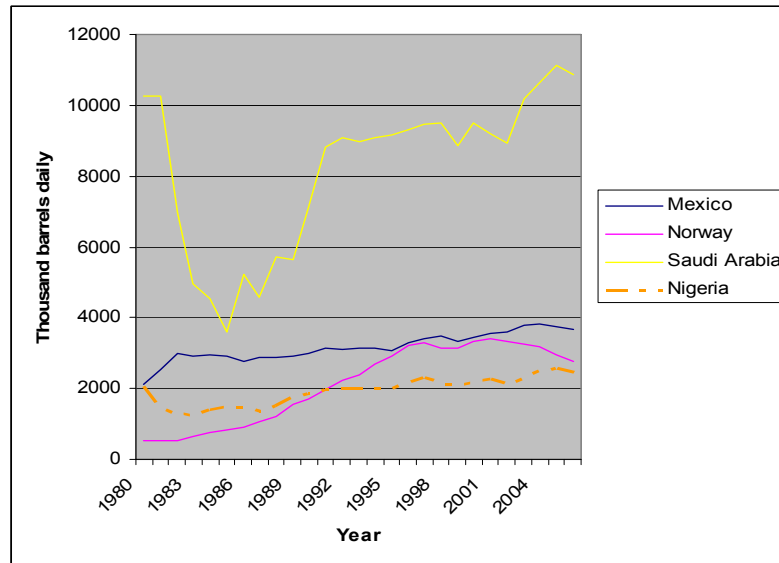


⁹ Data for interest rates for 30-year U.S. Treasury Bills is taken from www.treasurydirect.gov.

¹⁰ Data for U.S. inflation is taken from www.worldbank.org.

¹¹ The oil proved reserves are used instead of total expected reserves due to the availability of data.

Fig. 2.2. Oil production, 1980-2006



The difference in the optimal spending rates between Saudi Arabia, Nigeria, Mexico and Norway can be explained by the fact that Norway and Mexico have smaller current reserves which go to numerator in the formula for the spending rate in comparison with Nigeria and Saudi Arabia (see Figure 2.1). Oil production for Mexico, Norway and Nigeria fluctuates almost in the same region from 500 up to 4000 thousand barrels daily. Saudi Arabia has much larger level of oil production especially in the second half of 1990s which corresponds to higher level of oil proved reserves. So if we put these values into the formula, we will see that the optimal spending rate is high for Saudi Arabia and lower for Nigeria, Mexico and Norway.

All spending rates are high (see Figure 2.3) because future oil prices are assumed to be developed according to Hotelling hypothesis which gives relatively large increase in them (see equation (12)). So if oil price shock ε_t ($\varepsilon_t > 1$) is permanent and oil prices grow with interest rate (Hotelling hypothesis), then the impact of the shock is $(1+r)^{s-t} \varepsilon_t$ and government can consume much more after shock, what Figure 2.3 exactly confirms.

Time series of optimal spending rates for 1980-2006 were also calculated using the formula (19). As we see on Fig. 2.4, the optimal spending rate for Saudi Arabia in 1980 is quite low in comparison with 2006 – 1,7 vs. 2,5 due to discovery on enormous oil reserves. The same happened to Nigeria – 0,8 in 1980 vs. 1,5 in 2006. Mexican and Norwegian optimal spending rate decreased due to declined oil reserves. In 1980 they were equal to 2,3 and 0,7 correspondingly and in 2006 to 0,4 and 0,3. Under the fall in prices in 1986 the optimal

spending rate declined sharply for Saudi Arabia, negligibly for Nigeria, stayed the same for Norway and increased for Mexico. Under the recent oil price increase in 2003-04 the optimal spending rates decreased for all countries except Norway where it didn't change. Hence the change in the optimal spending rate reflects the change of countries' policy and changes in output.

Figure 2.3. Average spending rates for the case of permanent multiplicative shock, 1980-2006

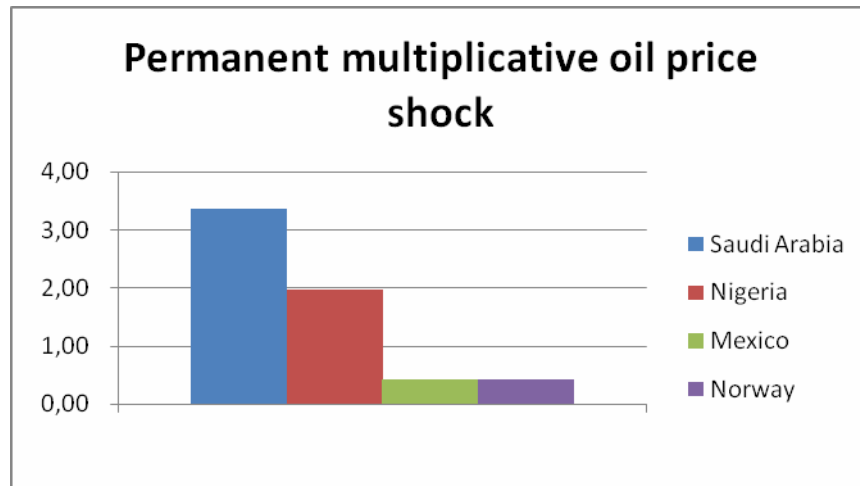
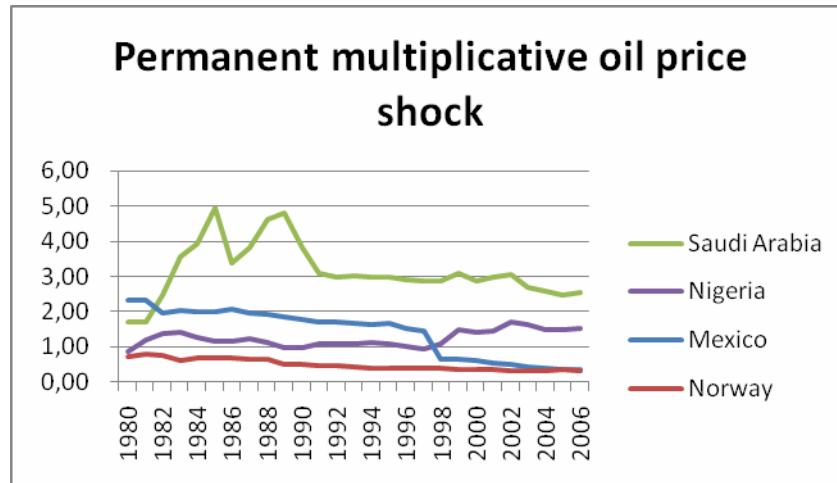


Figure 2.4. Time series of spending rates for the case of permanent multiplicative shock, 1980-2006



Let's find the optimal spending rates for other two cases – for temporary and permanent additive oil price shock (see equation (9) and (11)). In the first case it will be equal to:

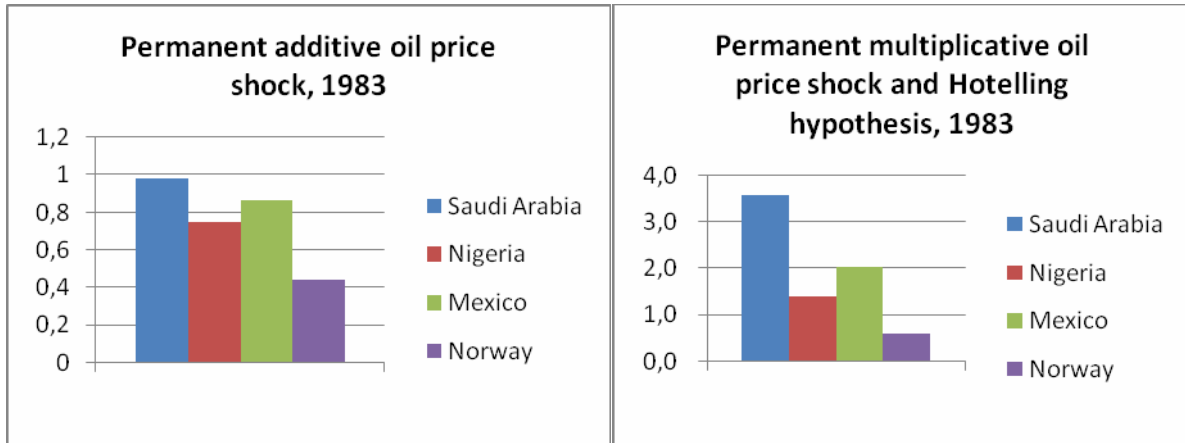
$$\frac{\frac{r}{1+r}x_t}{x_t} = \frac{r}{1+r} \quad (20)$$

And in the second case it will be equal to¹²:

$$\frac{\bar{x}_t}{x_t} = \frac{\frac{r}{1+r} \left\{ \sum_{s=t}^{\infty} \left(\frac{1}{1+r} \right)^{s-t} x_s \right\}}{x_t} \quad (21)$$

Using the formulas (20) and (21) let's compare the spending rates under different oil price shocks (see Fig. 2.5 and Fig. 2.6). For simplicity I use a particular year (here I chose 1983) to make comparison possible. In the case with a permanent additive shock there is an assumption of every year's constant future time path of production. Under the permanent multiplicative oil price shock the spending rates are the highest one as this is extreme case, under the permanent additive oil price shock the spending rates are considerably lower, and finally under the temporary oil price shock the spending rates are the lowest ones and always constant. These findings correlate with the findings about the levels of consumption under different assumptions about oil price shocks. Difference between the two cases with permanent shocks has to do with the assumption of trend growth in the oil price, i.e. Hotelling hypothesis. If we didn't have this price trend, the impact of the additive and multiplicative shocks would be about the same. Hence if shock is permanent and Hotelling hypothesis is applied, then the social planner can spend much more than if it would be no assumption about Hotelling hypothesis and shock would be still permanent (see Figure 2.5).

Figure 2.5. Optimal spending rates for the case of permanent additive and multiplicative shocks in 1983

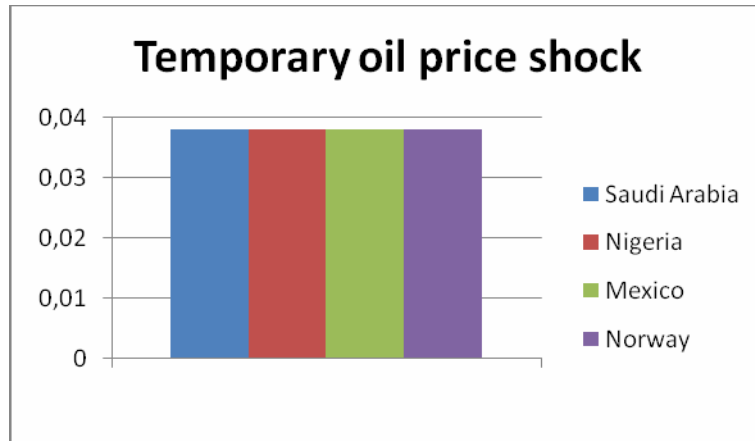


¹² First it was figured out the number of years of oil production $T = \frac{X_t}{x_t}$. Then using the assumption of constant

production each year until reserves are exhausted the denominator was calculated as

$$x_t + \frac{1}{1+r}x_t + \frac{1}{(1+r)^2}x_t + \dots + \frac{1}{(1+r)^{T-1}}x_t.$$

Figure 2.6. Optimal spending rate for the case of temporary shock, 1980-2006



2.3 Non-quadratic preferences and precautionary savings

Concerning the case of uncertainty, precautionary savings should be mentioned. In the model above taking into consideration assumptions of quadratic utility function the social planner makes decision under uncertainty as if expected values were certain to be realized (certainty equivalence principle). And precautionary behaviour consists in the following: if the oil prices are high, you shouldn't raise consumption to a high level as there is possibility of low prices in the future. Instead you have to accumulate a buffer of assets to run down in case of negative income shocks¹³. Precautionary savings are especially relevant in the case of permanent shocks. Then they help significantly to smooth consumption between periods.

To understand the mechanism of precautionary savings we need to have in mind equation (4)¹⁴ and to look at expected marginal utility which is determined by the third derivative of the utility function, $U'''(C)$. If $U'''(C) = 0$ as in the case of quadratic utility function, uncertainty doesn't influence expected marginal utility function. Hence an increase in uncertainty, i.e. an increase in the variance of the consumption, doesn't affect expected marginal utility and social planner doesn't follow precautionary behaviour. If $U'''(C) > 0$ as in the case of exponential utility function or isoelastic utility function, it means that marginal

¹³ Obstfeld and Rogoff (1996)

¹⁴ See equation (4): $U'(C_t) = (1+r)E_t\{\theta U'(C_{t+1})\}$.

utility function is a convex function of consumption. Hence an increase in uncertainty of future consumption raises the expected marginal utility of consumption¹⁵. To hold equation (4) the right-hand side of which has risen, the left-hand side, namely $U'(C_t)$, has to increase too. This happens if C_t falls (as $U''(C_t) < 0$) and hence savings increase, in other words the social planner is following the precautionary behaviour.

In the first case of oil price shock (temporary shock which doesn't influence the following oil price formation) and in the second and third cases (permanent shock which follows random walk and random walk with the trend) uncertainty doesn't matter if we have quadratic utility function: social planner behaves according to certainty equivalence principle and doesn't do precautionary savings: if the oil price is high, he/she will increase consumption and decrease savings.

But in the last case (two types of shock simultaneously) uncertainty matters for exponential function and the social planner will follow precautionary behaviour. The temporary and permanent shock will influence differently the strategy of the social planner. If you make mistake thinking that temporary rise in oil prices is permanent, then you will get utility loss. The most conservative approach is to consider a positive shock as temporary and a negative shock as permanent. Hence government which is following this strategy will save a lot but unfortunately will have uneven consumption.

2.4 Example of consumption-smoothing behaviour

Saving fund can represent an example of consumption-smoothing behaviour. The scheme for establishing and financing a hypothetical saving fund is represented in Table 2.1.

Suppose in this hypothetical economy a real rate of return is four percent. Then the discounted value of oil revenue is equal to 947,961 today (see Table 2.1). If government decides to invest this money, it will earn 37,918 at the rate of four percent every year. Using just this amount it will keep oil wealth untouched and will allow to smooth consumption between present and future.

¹⁵ Blanchard and Fischer (1989)

The aim is to establish a fund which wealth would be equal to 947,961. Using oil resources appropriately this allows to make a country richer and to smooth consumption between generations. Otherwise consumption would be small in the first years, later it will reach its peak at the tenth year and afterwards starts to decrease creating inequity in the distribution of natural wealth.

The oil revenue in the first year is equal to 10 but the necessary amount is 37,918, so the rest is being borrowed. The established fund begins its work with 0 and has to borrow -27,918. At the second year the oil revenue has increased to 20 but still the fund has the accumulated debt equal to 46,954. The debt accumulating stops at the sixth year when oil revenues are large enough to exceed the amount needed every year of 37,918. The fund is built up until the twentieth year when oil extraction is stopped and the fund wealth is exactly equal to the present value of oil revenues 947,961. So now if the rate of return is sustained at the same or higher level, it can last forever. So here it was made an example of how non-renewable resources have been transformed into renewable by the device of an investment fund¹⁶.

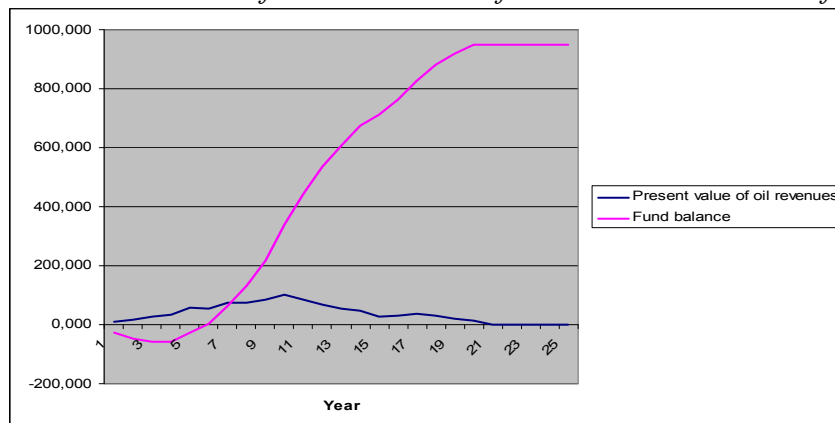
Table 2.1. A hypothetical petroleum fund

Year	Oil Revenue	Present value of the oil revenue	Deposit to fund	Fund balance (beginning of the year)	Fund yield	Fund balance (end of the year)
1	10	9,615	-27,918	0,000	0,000	-27,918
2	20	18,491	-17,918	-27,918	-1,117	-46,954
3	30	26,670	-7,918	-46,954	-1,878	-56,750
4	40	34,192	2,082	-56,750	-2,270	-56,939
5	70	57,535	32,082	-56,939	-2,278	-27,135
6	70	55,322	32,082	-27,135	-1,085	3,862
7	100	75,992	62,082	3,862	0,154	66,098
8	100	73,069	62,082	66,098	2,644	130,823
9	120	84,310	82,082	130,823	5,233	218,137
10	150	101,335	112,082	218,137	8,725	338,945
11	130	84,446	92,082	338,945	13,558	444,584
12	110	68,706	72,082	444,584	17,783	534,449
13	90	54,052	52,082	534,449	21,378	607,908
14	80	46,198	42,082	607,908	24,316	674,306
15	50	27,763	12,082	674,306	26,972	713,360
16	60	32,034	22,082	713,360	28,534	763,976
17	70	35,936	32,082	763,976	30,559	826,617
18	60	29,618	22,082	826,617	33,065	881,763

¹⁶ Hannesson (1998)

19	40	18,986	2,082	881,763	35,271	919,115
20	30	13,692	-7,918	919,115	36,765	947,961
21	0	0,000	-37,918	947,961	37,918	947,961
22	0	0,000	-37,918	947,961	37,918	947,961
23	0	0,000	-37,918	947,961	37,918	947,961
24	0	0,000	-37,918	947,961	37,918	947,961
25	0	0,000	-37,918	947,961	37,918	947,961
Present value of oil revenues (W)		947,961				
Annual yield of W at 4 percent		37,918				

Figure 2.7. Present value of oil revenues and fund balance at the end of the year



2.5 Other models

There are numerous other models examining the problem of intertemporal consumption and saving levels that are distinguished between themselves by different assumptions and approaches. For example, it can be presumed that oil wealth is not invested in real or financial assets as in the previous model but just kept “under the ground” out of reach by politicians.

Other variations are concerned about solving the Solow model for the closed economy emphasising the capital and labour endogenizing. Hannesson (1998) finds the optimum capital stock under the golden rule and the modified golden rule. He maximizes the discounted sum of utilities from now to eternity with respect to the growth rate of the capital stock. The labour force is ignored and assumed to be constant. There is also no technical progress to focus on the issue of use of petroleum wealth¹⁷. The discovery of the oil wealth

¹⁷ Hannesson (1998)

helps to increase the current consumption and to accumulate capital in order to raise future consumption. The quantity that should be used for the latter purpose is defined by the initial capital level relative to the steady state. If the capital level is too high, then there was overinvestment in the past and it can be afforded to consume more now. In the opposite case, the current consumption should be limited in order to increase investments for future generations. When steady state is achieved all the oil wealth can be spent on consumption as in this case consumption is constant for the present and next generations.

Bjerkholt, Olsen and Strøm (1990) take up a model where oil prices and costs are determined outside. The model's objective function is again the discounted sum of utility of consumption. The national wealth consists of four elements: natural resources (petroleum), real capital, human capital and net foreign debt. There are two sectors in economy: the first one deals with petroleum that can be bought and sold at the market prices which are assumed to be constant in the model, and the second deals with all other goods. Production of the petroleum resources depends on the size of its reserves and on the profits from the real capital. All petroleum is assumed to be exported. Production of other goods depends on the real and human capital. Other assumptions are constant population and no technical progress. The achieved result is that optimal and constant change in consumption in the long run is equal to the product of real interest rate in the world market and oil wealth. Net marginal productivity for real and human capital are equal in the long run and are besides equal to the marginal interest rate at the international financial market.

Another type of model is given by Bjerkholt and Offerdal (1985) where production and investment are exogenous and no labour is involved in the oil production; the objective function represents the discounted value of instantaneous per capita consumption weighted by the number of consumers, given the terminal conditions on net foreign assets and domestic non-oil capital¹⁸. According to the result they got the rate of optimal consumption growth is highly dependent on some of the exogenous assumptions such as the rate of time preference, the negative of the income flexibility and the own rate of interest of foreign assets.

¹⁸ Bjerkholt, Offerdal (1985)

3. Historical description of leading world oil exporters

This chapter gives description of historical perspective of four out of 10 top oil net exporters according to the rating made up by Energy Information Administration (the U.S. Government) (see Table 3.1). The chosen countries are Saudi Arabia, Nigeria, Mexico, and Norway. Making the choice I tried to look at the countries belonging to different geographical regions (Middle East, Africa, North America, and Europe), characterised by completely different historical, cultural, social and economic backgrounds. But there is one factor that unites all these different countries – it is oil abundance. Hence analyzing the usage of oil windfall we will see that it is internal factors that explain the effective or ineffective application of oil money in economy, successful or unsuccessful economic development and rapid or slow economic growth. There are no universal rules how to behave to have economy blessed and not cursed by oil because every country has its unique set of historic traits but there are some lessons that can be learned.

Another criterion for choosing countries is availability of the data which is difficult to obtain for Middle East and African countries¹⁹. Here I used a lot the databases of World Bank, OPEC and statistics from the Central Banks and National Bureaus of Statistics (www.sama.gov.sa, www.cenbank.org, www.nigerianstat.gov.ng, www.banxico.org.mx, www.ssb.no).

Table 3.1. Top World Oil Net Exporters

Top World Oil Net Exporters, 2006 (thousand barrels per day)		
Rank	Country	Exports
1	Saudi Arabia	8,525
2	Russia	6,816
3	United Arab Emirates	2,564
4	Norway	2,551
5	Iran	2,462
6	Kuwait	2,342
7	Venezuela	2,183
8	Nigeria	2,131

¹⁹ For Nigeria the majority of historical time series ends in 1987.

9	Algeria	1,842
10	Mexico	1,710

Source: www.eia.doe.gov

3.1 Saudi Arabia

The main source which was used to describe Saudi Arabia is Auty (2004) and data are taken from Saudi Arabian Monetary Agency (www.sama.gov.ng).

Saudi Arabia is an example of the country with enormous oil reserves equal to 264 251 million barrels in 2006²⁰ which experienced accelerated growth in 1970s, growth collapse in 1980s and disappointing economic performance in 1990s with private investment falling in real terms each year since 1981/82²¹. It is worth mentioning that population of that country consisted just of 25 million of people in 2007. That gives us one special characteristic – namely, quite small ratio of population to country's oil reserves.

The Kingdom of Saudi Arabia found its oil reserves in 1938. Those times the country was quite poor but oil booms in 1970s pushed government to develop a new strategy of overall spending embodied in a series of five-year plans.

As we see on Figure 3.1, oil production increased rapidly and doubled from 1970 to 1980. That in combination with oil price booms let oil revenues increase from 35% of GDP to 60% of GDP (see Table 3.2). Saudi Arabia didn't chose the rentier strategy which was followed by Kuwait as accumulating assets abroad and living on the rent stream would imply constant reliance on imports for goods and services. So in 1974 the government attempted to extract oil at a moderate pace (see Fig. 3.1) in order to have a sustainable growth, to ensure a steady, lasting income and to meet social goals. That is why during the first oil shock in 1973-74 government oil revenues didn't increase (see Table 3.2). However the country experienced surplus of 40% of GDP due to the huge oil revenues.

Increasing international demand and price forced the Saudis to formulate a new strategy²² that ended up in the Second Development Plan (1975-80). The new priorities were made and they concluded in sustaining a high rate of economic growth, decreasing dependency on oil

²⁰ www.opec.org

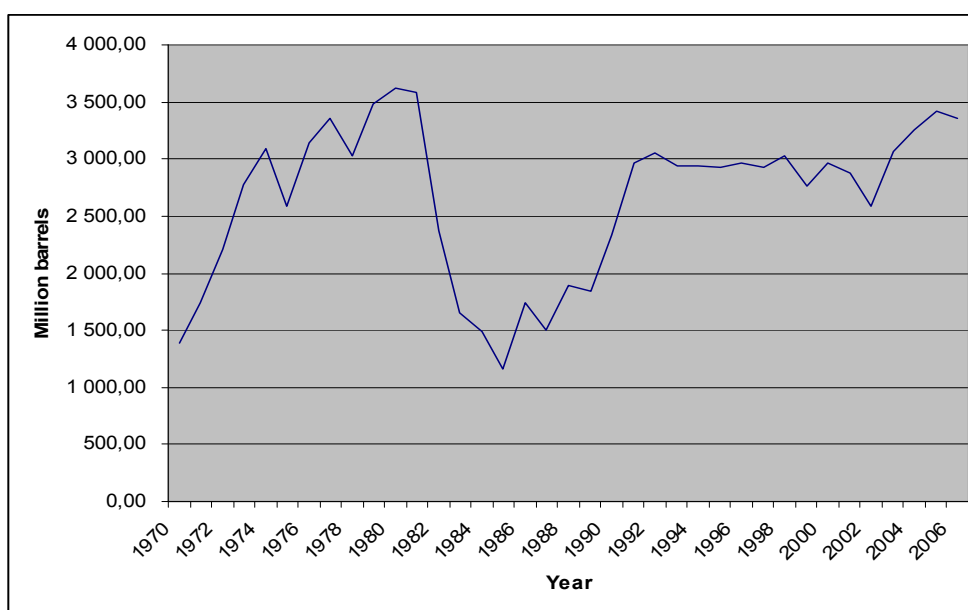
²¹ Looney (1992)

²² Hilarie (2004)

which rent made up over 60% of GDP (see Table 3.2), developing domestic productive capacity and investing in physical infrastructure and human capital (see Table 3 in Appendix).

Under the second oil price shock in 1979-80 oil production and oil revenues increased in comparison with first oil price shock (see Fig. 3.1) but reached the same value of 58% of GDP and surplus reached 20% of GDP (see Table 3.2).

Figure 3.1. Gross oil production for Saudi Arabia, 1970-2006



Source: www.sama.gov.sa

Table 3.2. Saudis Government oil revenues and finances 1970-2006 (% of GDP)²³

	Government Revenue	Government Oil Revenue	Government Expenditure	Surplus
1970	35,2	31,6	27,9	7,3
1971	36,5	31,8	26,7	9,8
1972	40,2	35,2	26,6	13,6
1973	77,9	73,4	34,7	43,2
1974	62,7	59,0	21,9	40,7
1975	63,2	57,1	49,6	13,5
1976	60,3	53,8	56,9	3,4
1977	50,1	43,7	52,9	-2,8
1978	48,3	42,3	54,4	-6,1
1979	56,3	50,4	49,5	6,8

²³ Budget allocation for fiscal year 1991 was amalgamated with the budget allocation for 1990.

1980	63,7	58,4	43,3	20,4
1981	59,2	52,8	45,8	13,4
1982	47,0	35,5	46,7	0,2
1983	46,4	32,6	51,7	-5,3
1984	40,8	28,9	51,5	-10,7
1985	35,5	23,5	48,9	-13,4
1986	23,8	13,2	42,7	-18,9
1987	32,4	21,0	57,6	-25,3
1988	25,6	14,6	42,6	-17,0
1989	32,1	21,3	43,4	-11,3
1990				
1991	64,4	50,1	99,1	-34,7
1992	33,2	25,2	46,8	-13,6
1993	28,6	21,4	38,0	-9,4
1994	25,6	19,0	32,6	-6,9
1995	27,5	19,8	32,6	-5,1
1996	30,3	23,0	33,5	-3,2
1997	33,3	25,9	35,8	-2,6
1998	25,9	14,6	34,8	-8,9
1999	24,4	17,3	30,5	-6,0
2000	36,5	30,3	33,3	3,2
2001	33,2	26,8	37,2	-3,9
2002	30,1	23,5	33,0	-2,9
2003	36,4	28,7	31,9	4,5
2004	41,8	35,2	30,4	11,4
2005	47,7	42,7	29,3	18,4
2006	51,5	46,2	30,1	22,2

Source: www.sama.gov.sa

Saudi Arabia tried to diversify production and to create valuable competitive tradable sectors to keep development and to raise economic growth. An important industry was manufacturing which had had very low level of development initially before oil shocks. But the emphasis was still kept on oil refining and petrochemicals rather than metals what didn't mean actually truly diversification of production. In 1970-72 manufacturing industry which was capital- rather than labour-intensive industry generated 7% of GDP (see Table 4 in Appendix). Agriculture was just 4% of GDP with two-thirds of people employed there. Big subsidies were made to large farms in order to support dairy and wheat production²⁴ in the north of the country whereas farms in the south-west remained poor and were the main source of employment. Social and economic infrastructure received a huge amount of

²⁴ In 1992 wheat production peaked at 4 million tonnes and absorbed almost \$2 billion in subsidies (Financial Times 1996).

investment which was equal to 375 billion riyals in 1973. But the country was still highly dependent on costly supplies of desalinated water.

The Third Development Plan (1980-85) (see Table 3 in Appendix) placed particular emphasis on agriculture, industry and mining and limitation of foreign work force. Government tried to expand resource based industry involving joint ventures between state-owned enterprises and multinational resource corporations for development of non-oil sectors and it benefited a lot from it.

The oil price decrease in 1981 after the second oil price shock (see Figure 4.1) pushed Saudi Arabia to cut its production to less than one third of previous level (see Figure 3.1). By that means Saudi Arabia kept up oil prices and didn't let them fall much. Only Saudi Arabia could take this kind of measures as it was dominant actor in OPEC and it had enormous reserves (see Figure 2.1). Other countries couldn't react in the same way because their reserves were found later. Hence Saudi Arabia can be described as a swing producer.

The oil price decrease in the beginning of 1980s brought decrease in oil revenues which reached its minimum equal to 13% of GDP in 1986 (see Table 3.2). Together with reduced oil revenues Saudi surplus transformed into continuous deficit since 1983. In the 1980s the taxation system was still based on the oil sector as in 1970s. Personal income tax was not levied and import taxes were set quite low. Besides, free government services and subsidies for fuel, water and electricity were granted.

Other special features of Saudi Arabia were that the country was open to trade and to labour migration and that it had enormous foreign assets. Government accumulated them to avoid over-rapid absorption of oil revenues heavily spent on consumption and subsidies and to smooth fluctuations of the oil revenues. The accumulated overseas assets peaked at around \$170 billion in the early 1980s and that was equivalent to over two-fifths of the oil revenue stream from the two previous oil booms²⁵. However not all the money could be drawn upon because some of it was loaned to such country as Iran and became non-redeemable because of the war.

²⁵ Auty(2004)

In the 1990s oil revenues fluctuated a lot from 50 to 14% of GDP accompanied by government deficit. However the new oil price shock in 2003 brought surplus again and increased rapidly oil revenues to 29% of GDP (see Table 3.2).

Hence Saudi Arabia is the example of the country with abundant oil reserves which invested heavily in the public sector in 1970s and didn't support much its competitive private sector. It didn't also manage to sustain economic growth of 1970s and started real diversification of its economy in 1990s when financial assets abroad were exhausted and domestic debt was accumulated. Saudi Arabia still remains highly dependent on oil resources which are not invested in the capital market and are kept in the ground. Due to its enormous oil reserves it can perform as a swing producer.

3.2 Nigeria

The main source for historical description of Nigeria is Ross (2003); limited series of data (mainly until 1987) are available online on the web-site of Nigeria's National Bureau of Statistics (www.nigerianstat.gov.ng).

Nigeria is one of the poorest countries in West Africa²⁶ that has to pay vast external debt equal to \$35,9 billion which comprises over \$30 billion to the "Paris Club" group of creditors²⁷ though it is world's eighth oil exporter (see Table 3.1) and is among the fifteen world's largest oil producers. Petrodollars invaded quickly the country and brought terrifying consequences: increased poverty and inequality, decreased life expectancy, brought corruption and black economy and damaged ecosystem. Now 85 percent of oil revenues accrue to 1 percent of the population; of \$400 billion in revenues, perhaps \$100 billion have simply gone "missing" since 1970²⁸.

Nigeria became one of the oil strategic players right after the civil war that was started in 1967. In 1969 when the war was finished Nigeria seemed to begin its recovering being

²⁶ Every fifth in Africa lives in Nigeria; two thirds of the population that amount to over 90 million people live on less than one dollar per day in 2005 compared with 19 million in 1970s; every fifth child dies before its fifth birthday (www.oxfam.org.uk)

²⁷ Justice for Nigeria: why the UK should return to Nigeria's £1,7 billion to fight poverty (2006), www.oxfam.org.uk

²⁸ Watts (2006)

characterized by potentially large domestic market and a resilient agricultural sector. In 1971 it joined OPEC as its eleventh member. The following oil shocks brought country below pre-shock levels of development.

Nigeria has been dependent on oil exports since the first oil price shock and was receiving 99,6 percent of its export income from oil in 1973-74²⁹ compared to oil export in the end of 1950s that was equal just to two percent. In 1960s-70s eight companies got license to explore oil in Nigeria, and a special governmental agency the Nigerian National Oil Corporation was set up. A state-led program was launched to modernize economy. The “oil complex” emerged and was meant to be a core of the economy.

Oil output was equal to 823 million barrels (see Fig. 3.2) and government revenue from oil reached 21,56 percent of GDP in 1974 (see Table 3.3). Besides doubling of oil revenues the positive oil price shock in 1973-74 brought government surplus, however not for a long time (see Table 3.3). During the following years oil revenues were quite stable due to stable oil taxes. The next shock in 1979-80 repeated the success of the first shock raising oil revenues to 28% of GDP and changing deficit to surplus again (see Table 3.3). That convinced Nigerian government to rely on the oil sector in the long-term.

Spending of oil resources was mainly aimed at increasing GDP growth, even through doubling of wages in the public sector. The situation in the non-oil sectors, especially in agriculture, was much worse. Agriculture supposed to be a cushion during recession times for Nigeria, however government didn't think about it and made very small investments in this sector targeting mainly large farms and forgetting about small peasant farms. That yielded a poor return and led to severe “Dutch Disease” in agricultural sector. Besides the growth of manufacturing sector was very unstable because it had been underdeveloped from the pre-shock times (see Table 5 in Appendix). Furthermore a concentration of resource wealth in one region, and attempts by other regions to gain a share of it, contributed to the breakup and eventual re-establishment of centralized political power³⁰. So government tried to improve the situation and to gain political support by spending on infrastructure. Hence prime expenditures on education and roads should have demonstrated the effective use of oil

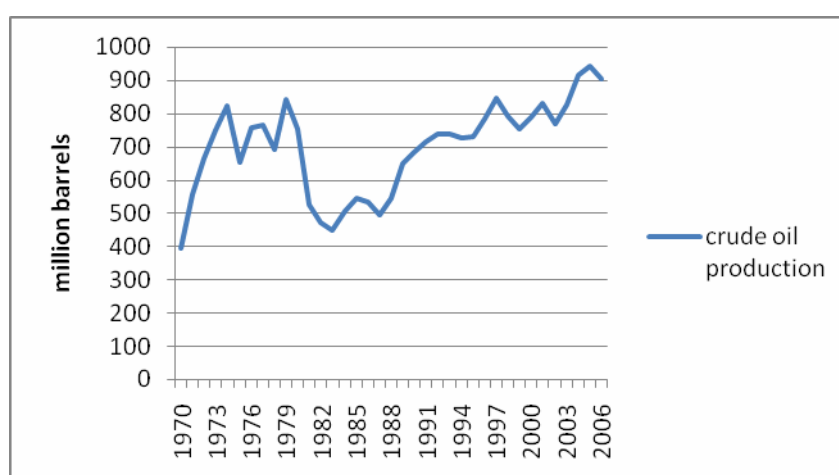
²⁹ Ross (2003)

³⁰ Lopez, Toman (2006)

revenues to the population and should have been a signal for changes in society. Besides large investments were made in manufacture but had very low efficacy due to high cost overruns and operational difficulties. The growth of manufacturing sector was very unstable because it had been underdeveloped from the pre-shock times. Moreover the problem was that mainly urban citizens benefited from these expenditures, and gap between urban and rural population was continuously growing. In addition employment opportunities enhanced migration from rural areas to towns.

Increase in government spending didn't cause the expected growth in GDP since 1980. Besides Nigeria saved very little. Strong increase in demand due to oil production and limited elastic supply spilled into consumption of imported goods and into other monetary transfers and payments for additional services³¹.

Figure 3.2. Gross oil production for Nigeria, 1970-2006



Source: www.bp.com

Table 3.3. Nigerian Federal Government oil revenues and finances 1970-1987(% of GDP)³²

	Government Revenue	Government Oil Revenue	Government Expenditure	Surplus
1970	5,0	3,8	10,1	-5,1
1971	7,5	5,8	6,41	1,1
1972	12,7	10,4	13,3	-0,5
1973	13,8	11,6	10,3	3,6

³¹ Schatz (1984)

³² Series stop early due to the availability of data.

1974	23,1	21,6	13,9	9,2
1975	24,0	22,4	25,9	-1,9
1976	23,7	22,3	27,5	-3,8
1977	24,0	22,7	26,3	-2,3
1978	18,9	16,9	21,8	-2,9
1979	25,4	25,1	17,3	8,2
1980	30,3	28,3	28,1	2,2
1981	23,6	21,5	21,2	2,37
1982	19,5	16,8	23,0	-3,4
1983	18,4	12,7	16,9	1,5
1984	17,5	12,9	15,0	2,5
1985	20,2	15,1	17,5	2,7
1986	16,8	11,1	22,2	-5,4
1987	23,1	17,5	20,2	2,8

Source: www.nigerianstat.gov.ng

After first oil shock in 1973-74 Nigeria increased its foreign exchange reserves but then government changed its policy. By 1978 all the savings abroad were spent and after a short break in the form of the second oil shock in 1979-1980 the country became again net borrower. Started from in \$567 million in 1970 the foreign debt boosted up to \$24,5 billion in 1986 with interest repayment to GDP of over 56%³³. Nigeria as Mexico used its oil resources as collateral to borrow money in foreign banks and then the huge part of it was spent intensively on consumption. The rest was spent on investments that were made often in projects with negative net present values or financing the budget deficit. Besides some money was spent on finance the consumption of imported goods.

During the 1980s oil production and oil revenues were highly volatile (see Fig. 3.2 and Table 3.3). However the sharp oil price drop in 1986 brought decrease in oil revenues to 11% of GDP and deficit equal to 5% of GDP.

Hence in 1986 the two-year Structural Adjustment Program (SAP) was established to address the debt problem with the following major objects³⁴:

- to restructure and diversify the productive base of the economy in order to reduce dependence on the oil sector and imports;
 - to achieve fiscal and balance of payments viability over the period;
-

³³ World Bank Debt Statistics (1988)

³⁴ Ezeala-Harrison (1993)

-
- to lay the basis for a sustainable non-inflationary, or minimal inflationary growth;
 - to lessen the dominance of unproductive investments in the public sector and improve the sector's efficiency, and intensify the growth potential of the private sector.

SAP gave the following advantages: the debt service ratio was rescheduled and consisted below 40 % compared with 76,4 % in 1987. Besides, Nigeria received a new loan of \$452 million from the World Bank.

Hence looking at the Table 3.3 we see that oil revenues and government surplus were quite volatile. The average for surplus is equal to 0,6% of GDP that is not so bad. Every time Nigeria had deficit it just borrowed new loan hoping to recover fast. Now it has accumulated a huge debt that it has to repay. Hence Nigeria is the example of the mere spending of oil revenues which turned out to be a curse for the country. Schatz (1984) described the economy of Nigeria as “Pirate capitalism” meaning that government and those who exploited oil revenues pursued just short-term goals of skimming oil revenues in 1970s and 1980s and didn’t constitute the goals of long-term wealth spreading. The consequences of that are reflected in the present economic situation.

3.3 Mexico

The main source which was used here is Everhart and Duval-Hernandez (2001); data are taken from the web-site of Banco de Mexico (www.banxico.org.mx).

Mexico is also one of the main examples of the resource curse. It experienced negative macroeconomic influence of resource abundance like some other countries that rely on oil export. Since the beginning of twentieth century Mexico has started to spend the oil windfalls. In 1938 the oil sector was nationalized initiating the full state control. At the same time there was fast development of manufacturing and service sectors and the oil sector got diminishing importance. By the beginning of 1970s, the oil sector represented only 2,5 percent of GDP and 3,5 percent of federal government tax revenues³⁵. In 1956 -1970 Mexico experienced phase of Stable Development (the so-called “desarrollo estabilizador”) after

³⁵ Everhart, Duval-Hernandez (2001)

which followed rising level of inflation, greater government's intervention in the economy, a large foreign debt in order to sustain economic growth and an overvalued exchange rate. In 1976 a balance of payment crisis happened, due to the fleeing of the private capital out of the country. Government had to abandon fixed exchange rate regime and hence peso was devalued by 40 percent.

During the first oil price shock oil revenue didn't increase significantly and country experienced small deficit (see Table 3.4). In the late 1970s oil production became more and more important (see Figure 3.3). Besides, Mexico invested huge amounts of money and used oil as collateral as it assumed that the 1979 oil shock heralded a permanent improvement in the country's terms of trade and used money instead of saving it³⁶. Moreover, Mexico exploited oil reserves to avoid the opening of its overprotected manufacturing sector which lead to boosted inflation and stopped non-oil export growth. In 1979-81 oil boom was intensified by an increase in public spending. Besides government deficit also ballooned in 1979-81 accompanied by increasing oil revenues until 1985. Lower import prices because of a real exchange rate appreciation lead to further increasing consumption boom while personal tax increase was not introduced. By 1982 the whole non-oil economy became non-tradable, which means that it needed constant subsidising or protection by state³⁷. In 1982 the government changed its strategy from autocratic regime and started to work towards stabilisation and market reforms. It managed to decrease expenditures as subsidies were cancelled and public investments also went down at the same time.

The main purpose of spending oil revenues for Mexican government was financing of large public investment projects³⁸, mainly of low return like military and bureaucratic ones. But expectations about oil prices were too bright and potential large revenues deterred money from other economic sectors and programs. That is why Mexican economy became weaker reflecting the fragility of funding the economy with oil money.

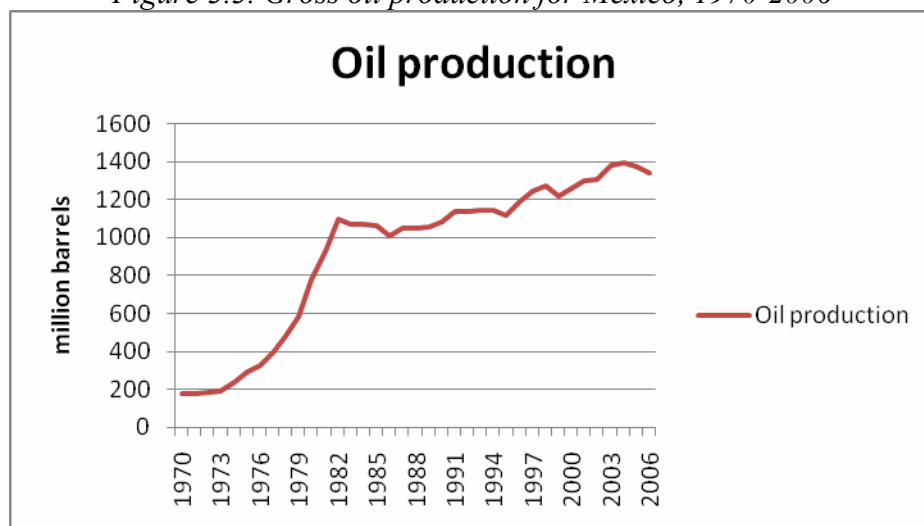
The 1986 oil price shock decreased oil revenues to 5% of GDP, brought recession and intensified deficit to 13% of GDP (see Table 3.4). Oil production continued to increase (see

³⁶ Auty (2004)

³⁷ Auty (1994)

³⁸ Everhart, Duval-Hernandez (2001)

Figure 3.3. Gross oil production for Mexico, 1970-2006



Source: www.bp.com

Table 3.4. Mexican Federal Government oil revenues and finances 1971-2006 (% of GDP)

	Federal Government Revenue	Federal Government Oil Revenue	Federal Government Expenditure	Deficit
1971	9,2	1,5	10,3	1,1
1972	9,4	1,4	11,5	2,1
1973	10,1	1,3	12,9	2,8
1974	10,6	1,7	13,5	3,0
1975	11,6	1,7	16,0	4,4
1976	11,9	1,7	16,0	4,1
1977	12,5	1,6	16,3	3,8
1978	13,0	1,7	16,4	3,4
1979	13,5	2,0	16,9	3,4
1980	15,3	4,0	18,1	2,8
1981	15,3	4,2	21,5	6,3
1982	15,6	5,9	27,1	11,5
1983	17,8	8,0	25,9	8,1
1984	16,9	7,3	24,3	7,5
1985	16,9	7,2	24,6	7,7
1986	16,0	5,6	28,9	12,9
1987	17,1	6,9	31,2	14,2
1988	16,3	5,0	25,5	9,8
1989	16,4	4,7	21,4	5,0
1990	15,9	4,2	18,5	2,6
1991	18,7	4,0	15,3	-0,2
1992	18,7	4,2	14,6	-1,5
1993	15,5	3,8	14,7	-0,8
1994	15,5	3,7	15,5	0,4
1995	15,2	4,9	15,9	0,7
1996	15,5	5,3	15,9	0,4

1997	15,8	5,2	17,1	1,3
1998	14,2	3,9	15,9	1,7
1999	14,7	4,0	16,6	1,9
2000	15,8	5,2	17,4	1,6
2001	16,2	4,9	17,3	1,1
2002	15,8	4,2	18,1	2,3
2003	16,4	5,2	17,9	1,5
2004	16,5	5,8	17,8	1,3
2005	16,9	6,5	18,1	1,2
2006	17,0	5,9	19,0	2,0

Source: www.banxico.org.mx

Fig. 3.3) but deficit hit economy until 1991. In the middle of 1980s to the end of the decade Mexico continued struggling trying to diverse export structure, opening the economy and broadening the participation of the private sector. Though the oil price was fluctuating around 20 US dollars per barrel, the oil exports declined sharply from 7 percent in 1987 to 3,7 percent in 1993 (see Table 3.4). It happened because government changed its policy. More or less the export of oil was stabilized in the second part of 1990s and didn't fluctuate dramatically – just around 4-5 percent of GDP.

The fall in the oil price in 1997-1998 was quite unexpected and harsh (12,08 US dollars per barrel (see Figure 4.1) - the lowest value in two last decades) and the strategy was still to increase oil production and oil export and to invest in oil infrastructure. In 1998 the PIDIREGAS investment agreement was concluded. It means that infrastructure investments are financed with the help of private sector. Some projects will become public investment as the government repays its debt to the private sector, others will become private investment with a long-term supply contract³⁹.

In 2000s Mexico has continued the same strategy of intensified oil production (see Fig. 3.3). However deficit didn't turn to surplus though oil revenues have increased slightly and have been fluctuating around 6% of GDP (see Table 3.4).

Manufacturing sector and services played important role in the creating of Mexican GDP. As in Nigeria agricultural sector didn't become cushion for economy and decreased significantly during the last 40 years (see Table 6 in Appendix). The same happened to manufacturing sector despite all investments programs, government protection and

³⁹ Everhart, Duval-Hernandez (2001)

development programmes. Nowadays the country is still hit by recession, inflation and poverty.

3.4 Norway

The main source for historical description of Norway is Larsen (2004); all data are available on-line on the web-site of Statistisk Sentralbyrå (www.ssb.no).

Norway being the forth largest oil net exporter in 2006⁴⁰ started to play its significant role at the international oil market quite recently – namely, since the second half of 1970s. In the late 1960s expectations about finding oil in the North Sea were realized. The exploration started in 1966 but oil was found only in 1969. The oil era coincided with first energy crisis and the quadrupling of oil prices, which was further fuelled by continued discoveries and a new oil price hike after the revolution in Iran in 1979⁴¹. Significantly oil production started only in 1975 and then it was constantly rising until 1997 (see Figure 3.4). The value of production decreased severely in 1986 but increased volume of production helped to raise it again in the late 1980s.

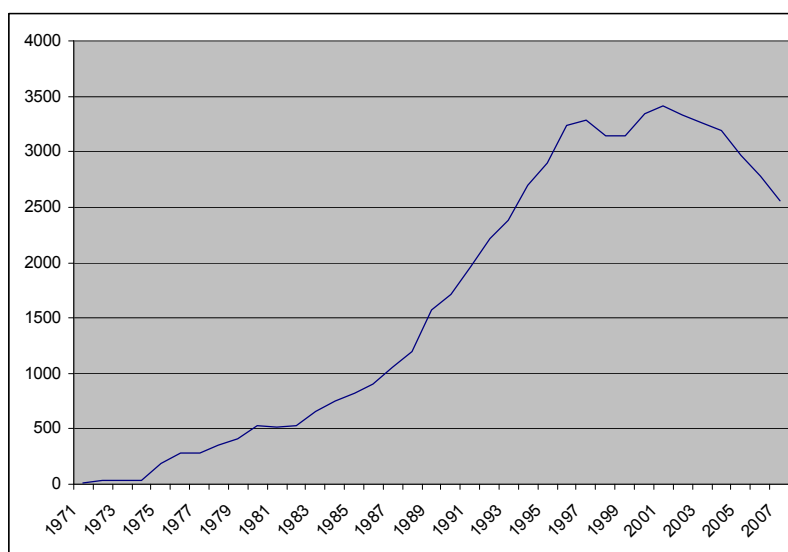
Government balance (see Table 3.5) fluctuated quite a lot in 1978-2006 influenced by the petroleum sector. In the mid-1970s there were made huge investments to human capital, real capital and technology in the oil sector. It took a while before oil revenues started to be sufficiently high to cover budget deficit. This partly explains the negative values of government values in the mid-1970s (see Fig. 5 in Appendix).

The second oil price shock in 1979-80 influenced slightly oil revenues as oil production just started (see Table 3.5). The sharp decline of oil prices in 1986 reflected far more negatively on oil revenues which diminished sharply from 9% to 3% of GDP.

⁴⁰ www.eia.doe.gov

⁴¹ Hannesson (2001)

Figure 3.4. Gross crude oil production (thousand barrels daily)



Source: www.bp.com

Table 3.5. Norwegian Government oil revenues and finances 1978-2006 (% of GDP)

	Government Revenue	Government Oil Revenue	Government Expenditure	Surplus
1978	46,1	2,5	45,1	1,0
1979	46,5	3,7	44,4	2,1
1980	49,1	7,3	43,8	5,4
1981	48,0	7,3	43,2	4,8
1982	47,7	7,2	43,8	3,9
1983	49,4	7,8	43,5	6,0
1984	48,5	8,5	41,6	6,9
1985	50,8	9,3	41,0	9,7
1986	50,3	3,3	44,5	5,8
1987	51,3	2,5	46,8	4,5
1988	51,2	1,6	48,6	2,6
1989	50,1	2,7	48,3	1,8
1990	51,3	4,5	48,8	2,5
1991	50,0	4,4	49,8	0,1
1992	49,5	4,0	51,2	-1,7
1993	48,8	4,1	50,2	-1,4
1994	49,7	4,1	49,3	0,4
1995	50,4	4,2	47,0	3,4
1996	51,2	6,7	44,8	6,5
1997	50,7	6,9	43,0	7,7
1998	48,9	3,2	45,6	3,3
1999	50,2	5,2	44,2	6,0
2000	54,7	13,1	39,3	15,4
2001	54,3	11,8	41,0	13,3
2002	53,2	10,1	44,0	9,2
2003	52,8	10,3	45,5	7,3
2004	53,8	12,2	42,6	11,1

2005	54,6	14,9	39,5	15,1
2006	56,9	16,3	38,3	18,6

Source: www.ssb.no

The rapid decline in manufactures export (see Figure 1 in Appendix) from 62 percent of merchandise exports in 1975 to 30 percent in 1984 and a decline in shipping shows the fast exclusion of these industries by oil industry. However this tendency was not as negative as in Mexico, Nigeria or Saudi Arabia as Norway had already been developed country with extensive physical infrastructure in addition to well-endowed systems of higher education and science⁴². Besides the important factor was the absence of rent-seeking explained by mature political and economic institutions. Norway experienced just restructuring of the economy and it didn't lead to the future problems as the reduction in the demand for training and education, a gradual erosion of the overall economic capacity, of the production capacity in the non-resource traded goods sector, or both⁴³. The Figure 2 in Appendix shows that the dependence on oil revenues was not increasing over time as in the countries hit by the Dutch Disease. From 1983 to 1988 the fraction of oil and natural gas in GDP was decreasing and from 1990 to 2000 it was fluctuating around 15 percent. Besides the export was varied and not just concentrated in the export of oil. Moreover the Norwegian oil sector commanded a fairly small and constant share of total labour hours⁴⁴ since the oil fields were allocated under the sea floor and not on-land as in the case of Saudi Arabia. So the oil sector needed huge capital and technology investments and was low labour-intensive. In other words, despite building up large liabilities for starting production, the oil resources were not an obstacle for further developing of the economy.

The following years from 1980s up to 2000s oil revenues had years of stability and increasing tendency (see Table 3.5). Norway experienced government deficit only in 1992-93 when economy was hit by crisis. In 20003-06, though it was found that oil reserves are not so large and it was decided to produce less, oil revenues increased due to positive shock in oil prices up to 16% of GDP giving the country growing surplus up to 18% of GDP (see Table 3.5).

⁴² Humphreys et al (2007)

⁴³ Larsen (2004)

⁴⁴ Larsen (2004)

Norwegian system of the centralised wage bargaining prevented the country from uncontrolled and fast real appreciation thus keeping the Norwegian economy away from de-industrialisation (see Cappelen, Eika and Holm (2000)). It is productivity in the manufacturing sector and not in the oil sector which was the guiding line for the general wage level thus not giving it to increase strongly. This made the effect of the oil sector upon the non-oil traded sectors more moderate (see Table 7 in Appendix).

Other problems which were successfully solved were the absorption of petroleum wealth in the domestic economy and the regulation of the demand. To tackle these fiscal policy difficulties, Norwegian government decided to establish the Norwegian State Petroleum Fund in 1990 (see Figure 3 in Appendix). Besides, to slow nominal appreciation the fund is kept in foreign currencies. The money is invested in different securities, namely government bonds, shares and derivatives. The preference of the fund is conservative strategy, namely low return and safety. The first donations to the fund were made only in 1995 when the economy recovered after severe recession in 1990-92.

The Norwegian State Petroleum Fund accumulates resources in the form of transfers if there is budget surplus and withdraws resources if there is budget deficit. Thus the Norwegian State Petroleum Fund effectively finances the overall budget balance⁴⁵. The Fund is controlled by the Ministry of Finance and its assets are managed by Norwegian Central Bank (Norges Bank). The main rules of the Fund are good governance, transparency and accountability.

The main functions of the fund are⁴⁶:

- The Oil Fund's key function is to diversify petroleum wealth into a broad portfolio of international securities (see Figure 4 in Appendix);
- This transition reduces the expected risk significantly and increases expected return;
- The Fund makes the income stream from non-renewable resources permanent;

⁴⁵ Davis et al (2001)

⁴⁶ Knut N.Kjaer (March 2008)

- The intention is to spend only the (expected) real return through annual public budgets, thus preserving the fund's capital for future generations.

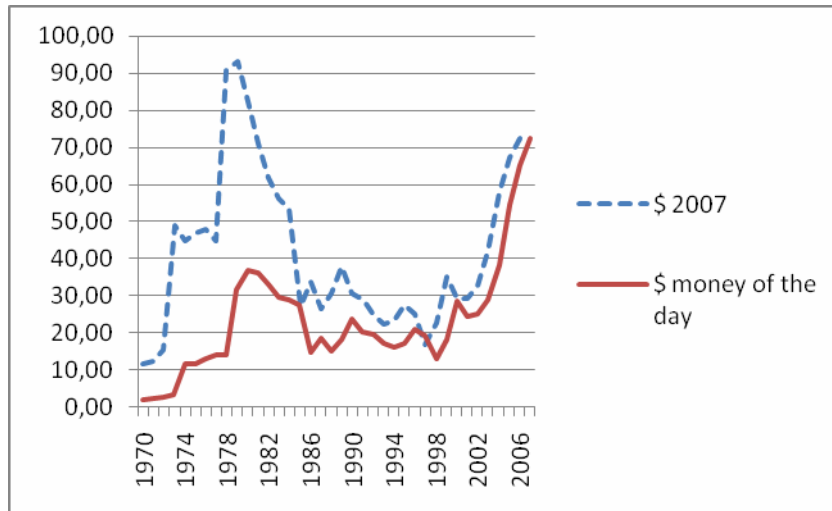
The Petroleum Fund was turned into a pension fund in 2006 to pay out the pensions for those who have been already retired. As the number of pensioners is growing and the number of workers is decreasing, the pension burden should be alleviated. In Norway it has been done with the help of the Norwegian Petroleum Fund.

Hence Norway is the example of the country, which managed to handle the oil revenues in the right way. Norwegian government has been successful in sustaining the economic growth, diversifying economy and preparing the country for the future without oil. The society of welfare has been built, and its essential principles are market-orientated management of the oil wealth, the conception of the oil resources as a taxable common property and mature politico-economic institutions and policy-making.

4. Comparison of four main oil exporters

Considering the oil price history the four main shocks can be marked out: the oil booms in 1973-74 and 1978-79, the negative oil shock in 1986 and recent jump in oil price in 2003-05 (see Figure 4.1).

Figure 4.1. Historical crude oil prices



Source: www.bp.com

The major oil-exporting countries reacted differently to the shocks – not only in comparison with each other but also in time. To understand the economic responses to the shocks the government and country's finances of Saudi Arabia, Nigeria, Mexico and Norway were studied and their statistics was used as a base for subsequent graphs. Analyzing the graphs and the economic history we shall try to figure out how governments injected oil windfalls in the countries' economies, which spending patterns they followed and what factors influenced them. Namely changes in public finances and in current account are considered (see Figures 5-8 in Appendix, Figures 4.5-4.7). These figures show difference between averages calculated for the years before and after oil price shocks. During oil price shock itself there is an immediate effect on oil revenues, government surplus etc. but it takes time to adjust tax system afterwards. That is why it was needed to look at the period after the shock. However it is difficult to say if the changes in public finances and finances of the country's level considered here were caused by oil price shocks only or some other factors.

So for the first oil price shock in 1973-74 there were calculated averages in 1971-72 and in 1975-76. Then their difference was depicted on Figure 5 in Appendix. For the second oil price shock in 1979-80 the period considered before shock is 1977-78 and the period

considered after the shock is 1981-82. The averages for these two periods were calculated. Then again the difference between these two averages was used (see Figure 6 in Appendix). For the third oil price shock in 1986 the averages for the period before the shock (1984-85) and the period after the shock (1987-88) were calculated and after that their difference was depicted (see Figure 7 in Appendix). For the last oil price shock in 2003-04 the period before shock is 2001-02 and the period after shock is 2005-06. The difference of the averages for these two periods is depicted on Figure 8 in Appendix.

Generally speaking there are three strategies that could be followed by resource-rich countries. First one is to spend oil income on current consumption and domestic investment. This strategy seemed to be popular in 1970s for developing countries whose development level was quite low and which desperately needed immediate improvement in the life quality. Besides absence of strong institutions created fears that oil windfalls would have been distributed unevenly. Hence government trying to win support of the population had to spend resources on consumption. However this policy can work out only for the countries with large oil reserves (Saudi Arabia, Nigeria). Besides precise long-term predictions about future oil prices are required which is hard to make.

Another strategy is quite conservative and lies in saving of all oil revenues and investing them abroad that gives the interest income to the country. The fruits of such behavior are postponed to the future and the population should absolutely trust to the government. This policy can be applied in the country with small oil reserves, which already achieved high level of development and institution system and diversified economy, for example as Norway. Advantage of this strategy is absence of dependency on highly volatile oil prices. Moreover higher than projected oil prices – or a better than expected performance of an oil field – are translated into more foreign assets, not more current expenditure⁴⁷.

If we look at the average optimal spending rates found in the Chapter 2 (see Fig. 2.3) we will see that the highest one was for Saudi Arabia. Then it was followed by Nigeria with big gap. Mexico and Norway had the smallest optimal spending rates very close to each other but still higher one for Mexico. Hence we see that these findings correspond with the two strategies stated above and chosen by the countries themselves.

⁴⁷ Setser (2007)

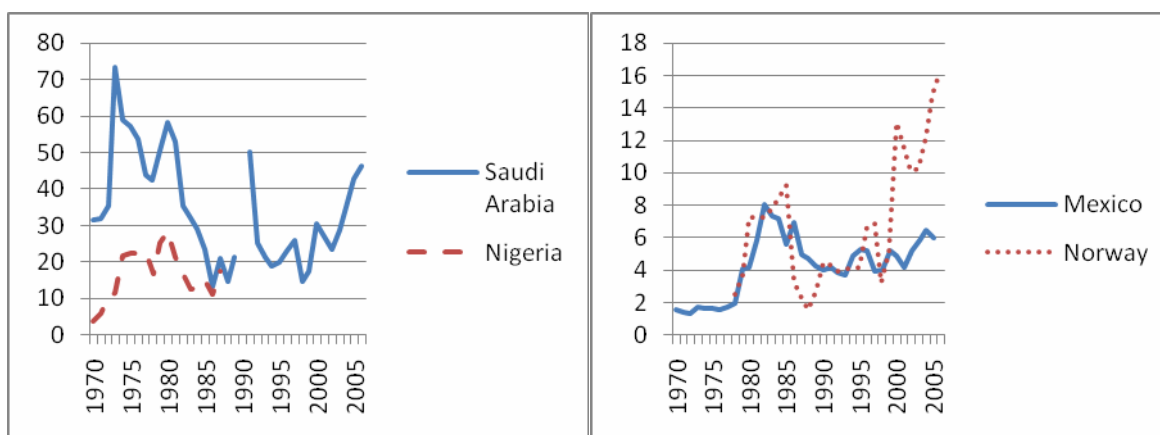
The third strategy is a strategy of permanent consumption, besides oil revenues which are left are invested in financial assets abroad to create dividends and interest payments. When oil resources are depleted, the income from financial assets will create a buffer for the economy. The disadvantage of that strategy is that it is difficult to make an accurate long-term forecast about oil price, oil reserves and interest rate for the foreign assets.

4.1. Government finances

4.1.1. Government oil revenues

The first characteristic I would like to discuss is government oil revenues. As we see on Fig. 4.1 the oil revenues were highly volatile for all four countries⁴⁸. Under the oil price shock in 1973-74 oil revenues rose significantly for Saudi Arabia and Nigeria and negligibly for Mexico. Under the following shock in 1979-80 the reaction was quite stronger for all four countries. The 1986 year and the following years brought sharp decrease for oil revenues. If we look at the recent data since 2003 (see Table 3.2, 3.3, 3.4, 3.5) constant increase in the share of oil revenues in GDP could be noticed. Therefore the share of oil revenues is quite unstable. However that could be explained not only by oil price and oil output changes but also by changes in output from other sectors, especially in the longer term.

Figure 4.1. Government oil revenues (% of GDP), 1970 - 2006⁴⁹



Source: www.sama.gov.sa, www.nigerianstat.gov.ng, www.banxico.org.mx, www.ssb.no

⁴⁸ The data for Nigeria is absent after 1987 (see www.nigerianstat.gov.ng).

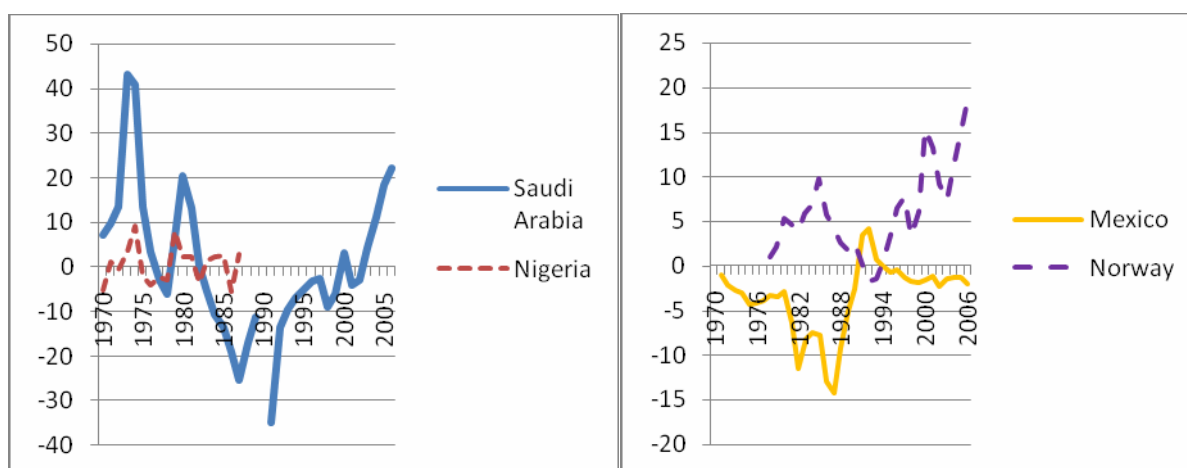
⁴⁹ There are gaps in the data for Saudi Arabia and Nigeria due to its exposition on-line (see www.nigerianstat.gov.ng, www.sama.gov.sa). The same explanation is applied further.

4.1.2 Government surplus

The item of government finances that is of particular interest and that is influenced indirectly by oil revenues is government's surplus. We see on Figure 4.2 that during 1973-74 the governments of Saudi Arabia and Nigeria had very high budget surplus. However it is remarkable that Mexico had almost always budget deficit despite additional revenue from oil. In 1979-80 there is noticed increase in government's surplus for Saudi Arabia, Nigeria and Norway and reduction in deficit for Mexico that coincide with increase in oil revenues that time. Decrease in oil revenues in 1986 corresponds with sharpening of oil deficit for the three countries except Norway, which had government's surplus but also experienced reduction in it. Recent rise in oil revenues helped Saudi Arabia to change its deficit to surplus since 2003. Norway had considerable increase in its surplus. However Mexico still couldn't change its deficit to surplus.

Hence we see that there is certain kind of interconnection between government oil revenues and government surplus/deficit. So let's look closer and figure out how change in oil revenues influenced the change in government surplus.

Figure 4.2. Government surplus (% of GDP), 1970 - 2006



Source: www.sama.gov.sa, www.nigerianstat.gov.ng, www.banxico.org.mx, www.ssb.no

4.1.3 Change in government finances

First let's look at the 1973-74 oil shock when oil price jumped from 3\$ to 12\$ (see Fig. 4.1) and compare the change in government finances before and after the shock, i.e. compare the average in 1971-72 with the average in 1975-76 (see Fig. 5 in Appendix). Increase in the oil revenues took place: Saudi Arabia experienced the strongest influence – 22% of GDP

against 14,3% of GDP in Nigeria and 0,2% of GDP in Mexico. The small increase for Mexico could be explained by the fact that oil didn't play a great role in the Mexican economy that time. In the beginning of 1970s mentioned countries just started their development and this positive oil price shock strengthened their wish to rely on easy oil-money: oil abundance seemed to be "bless".

Concerning government surplus Saudi Arabia, Nigeria and Mexico had decrease in it almost of the same size: 2,65% of GDP for Mexico, 3,13% of GDP for Nigeria and 3,2% of GDP for Saudi Arabia (see Fig. 5 in Appendix). This tendency could be explained by that the shock has immediate effect on government surplus but it takes time to adjust tax system after it has gone. That is why in 1975-76 surplus fall below its initial level in 1971-72. Besides there was increase in government expenditures supported by the belief that positive oil price shock would be permanent. Mexico had high increase in government expenditures in comparison with increase in oil revenues equal to 5,13% of GDP. Increase in government expenditures in Saudi Arabia and Nigeria is better comparable with increase in oil revenues (see Fig. 5 in Appendix).

On the whole the influence of the first oil shock was not dramatic as countries just started development of their economies relying on oil income.

The second oil price shock when oil price jumped from 14\$ to 31\$ (see Fig. 4.1) strengthened belief of the governments in the permanence of high oil prices. Comparing average of oil revenues in 1977-78 and in 1981-82 (see Fig. 6 in Appendix) Saudi Arabia, Mexico and Norway experienced increase with the largest increase in Norway equal to 4,76% of GDP (partly due to rapidly increasing oil production) and more modest in Saudi Arabia and Mexico – 1,2% of GDP and 3,38% of GDP, whereas Nigeria had decrease in oil revenues equal to 0,63% of GDP due to decreasing production as well. As Saudi Arabia was a leading actor in OPEC and discovered huge oil reserves it performed as a swing producer in 1980s. It cut its oil production in order to support oil prices at a high level after the second oil price shock. It was helpful as oil prices didn't decline so acute (see Fig. 4.1).

Concerning change in government surplus before and after 1979-80 three countries except Mexico had increase equal to 11% of GDP in Saudi Arabia, 3,3% of GDP in Norway and 2,07% of GDP in Nigeria (see Fig. 6 in Appendix). Increase in Mexican government deficit was around 5% of GDP. These facts exactly corresponds with decrease in government

expenditures: 7,4% of GDP in Saudi Arabia, 1,6% of GDP in Norway and 1,9% of GDP in Nigeria and increase in Mexico equal to 8% of GDP.

A big fall in oil price happened in 1986 when oil price reached the level of 14,43\$ per barrel (see Fig. 4.1). Three countries except for Nigeria which had higher level of production before and after the shock had fall in oil revenues: it was equal to 8,4% of GDP for Saudi Arabia, 1,29% of GDP for Mexico and 6,85% of GDP for Norway (see Fig. 7 in Appendix). As government surplus is closely linked to oil revenues in the oil-exporting countries, it also went down in Saudi Arabia, Mexico and Norway. Its decline was equal to 9,1% of GDP in Saudi Arabia, 4,12% of GDP in Mexico and to 4,77% of GDP in Norway. Nigeria had negligible increase in government surplus equal to 0,26% of GDP while increase in oil revenues was equal to 3,5% of GDP.

Despite the negative shock Nigeria had increase in government expenditures equal to 3,95% of GDP and Mexico as well where increase was equal almost to 4% of GDP. Norway had the highest increase in government expenditures amounted to 6,4% of GDP. Change in Saudi government expenditures was negligible – it declined on 0,1% of GDP. It can be explained by decreased oil revenues after the shock in 1986.

The next oil price shock is recent increase in oil prices in 2003-2004 when oil price reached 38\$ per barrel (see Fig. 4.1)⁵⁰. This influenced positively growth of oil revenues in Saudi Arabia, Norway and Mexico: they increased on 19,3% of GDP, 4,63% of GDP and 1,7% of GDP correspondingly (see Fig. 8 in Appendix). Nevertheless government surplus in contrast to 1980s increased everywhere. One reason may be that the price continued to go up, so “after” is not really after (see Fig. 4.1). The highest raise in surplus experienced Saudi Arabia that was equal to 23,7% of GDP, then it was Norway with the growth equal to 5,6% of GDP and finally Mexico with modest increase equal to 0,085% of GDP (see Fig. 8 in Appendix). As for government expenditures they declined in Saudi Arabia and Norway amounting to 5,4% of GDP and 3,6% of GDP. In contrast Mexico is the only country which had increase in government expenditures equal to 0,86% of GDP.

⁵⁰ In this section only Saudi Arabia, Mexico and Norway are discussed because data for Nigerian government finances is available only until 1987.

Increase in government surpluses under the second oil price shock generated a possibility to have rapid GDP growth which could be sustainable with the help of oil money. In the beginning of 1970s Nigeria tried to save extra oil revenues but lately government decided to cut down savings and accelerated spending reckoning oil price increase as permanent. Foreign debts which were taken to support government deficit but became unsustainable in 1980s worsened the situation. The left-leaning Mexican government spent the revenues basically to decrease poverty and to smooth social tensions introducing official stabilization program in 1975. Saudi Arabia which specialty is small population and large oil reserves decided to use its oil windfalls in the development of social and economic infrastructure. However Saudi Arabia having paternalistic autocracy wasn't forced to accelerate spending in order to pursue short-terms goals to have support of the population as in Nigeria and Mexico. It rather decided to make large allocations in foreign assets to regulate domestic absorption capacity.

Under the decrease of oil prices in 1986 Nigerian and Mexican oil income was used as collateral to attract foreign capital to the country in order to sustain economic growth. Excessive large cost investments' projects in transportation, primary education, mining, manufacturing and infrastructure were also started. All these activities outstripped domestic absorption capacity. Besides the quality of investments dropped as investments projects were carried out without proper attention to their economic viability, coordination, or sequencing, and with few safeguards against waste and corruption⁵¹. The rest of the oil revenues was spent as subsidies because national currency appreciated and to substitution of decreased (Mexico and Nigeria) or abolished personal tax (Saudi Arabia). Competitive industrialization was distorted. So governments of developing countries understood that some stabilization measures should be adopted. Incoming Nigerian government introduced a program of fiscal austerity in 1983, including across-the-board budget cuts, reduced imports, and foreign exchange rationing that resulted in many unfinished projects⁵². Saudi Arabia elaborated Third Development Plan for 1980-85 trying to sustain the economic growth and to diversify production promoting agriculture, industry and mining. New Mexican government also took measures in 1982 cutting public expenditures, removing subsidies and decreasing public investments.

⁵¹ World Bank (2007)

⁵² World Bank (2007)

Norwegian government in contrast interpreted oil price shocks as temporary and didn't consider oil as a permanent source of income. It was decided to stick to the conservative strategy and to save income which government got from the oil extraction rationally in order to have fair distribution of the oil wealth among generations.

Generally speaking here we see that the reaction of Saudi Arabia, Nigeria and Mexico was similar in 1970s. The increase in oil revenues associated with increase in government expenditures. Norway also followed this pattern in the beginning of 1970s having government deficit (see Fig. 5 in Appendix) but it stuck to the safe strategy of saving oil revenues. The negative shock in 1986 resulted in the far more individual reaction of each country and deepened the emerging differences among them. The lessons learnt from the history of oil using in the previous century lead to that countries changed their strategy of having positive relation between change in oil revenues and change in government expenditures. Diversification of production, the increase of the role of non-oil private sector and savings of oil revenues abroad became new common features of oil-producing countries.

Hence from looking at the change of government finances the pattern that can be traced is the following one: after finding oil developing countries relied heavily on oil revenues pursuing high GDP level without preventing the country from currency devaluation, overabsorption of oil money and finally inflation. They set short-term goals and were not bothered by the ideas of economic stability and equal distribution among the generations that is found to be optimal in theory. Consequently the considered countries except Norway had severe "boom-bust" cycles⁵³ caused by highly volatile oil revenues. But as the time showed the strategy of fast oil money spending failed and now the developing countries are trying to repeat the success of Norway which is known for its egalitarian values.

Among the factors that made Saudi Arabia, Nigeria and Mexico spent much of oil revenues on current consumption and investment were their political regimes. Eifert et al (2003) in their article defined four types of regimes, and these countries exactly represent each of them: Saudi Arabia has paternalistic autocracy, Nigeria has predatory autocracy, Mexico has factional democracy and finally Norway has mature democracy. So economic options of using oil revenues were already imposed by the state structure which defines information

⁵³ Eifert B. et al (2003)

transparency, institutional accountability, market competition and the significance of oil and non-oil traded sectors.

4.2 Whole country's level finances

4.2.1 Gross savings

Now let's look not only at the government finance but also at the whole country's level analyzing gross savings and current account balance. Comparing gross savings gives us interesting result which is different from the result obtained by calculating the optimal spending rates in Chapter 2: the real spending rates are quite smaller than the optimal ones (compare Fig. 2.4 and Fig. 9 in Appendix). The low spending rate for Norway coincides with the actual behaviour of the country which follows a conservative strategy with respect to uncertain future oil prices. Norwegian government prefers not to spend money before they have got it. For other small countries with big oil reserves like for example Saudi Arabia government has another strategy – first the country has to borrow money to start production. Then there is a choice: to spend a lot of oil windfall today or to make taxes low in order to smooth consumption. If oil price decreases, then government which relies heavily on oil revenues and has debt is in big trouble. Moreover, it takes time to understand if the oil price shock is temporary or permanent. So the safest strategy is to have in mind that a positive shock is always temporary and a negative shock is always permanent. Hence government which is following this strategy will save a lot but unfortunately will have uneven consumption.

Theory predicting negative relations between gross savings and the ratio of oil reserves to oil production fits well for Saudi Arabia and Norway. Gross savings decreased for Saudi Arabia on 53% if we compare the 1980 level with the level in 2002 (see Fig. 9 in Appendix). It is explained by increase in the ratio of oil reserves to oil production on 218% from 1980 to 2002 due to the discovery of new oil reserves. After 1981 gross savings started to decline though the oil price was decreasing as well. In 1986 when the oil price had large decline Saudis gross savings were very low – just 1,14% of GDP and reached their minimum equal to 1,01% of GDP next year whereas the ratio of oil reserves to oil production declined sharply in 1986 from 148 to 97 due to increased production. After that gross savings have had increasing trend up till now with the visible decline in 1991, 1994 and 1998 as a reaction

to economy recession and oil price shocks. The ratio was quite stable in 1991-1997, after that it had small decline in 1998, peak in 2002 and a declining trend again from 2002 to 2006.

Norway had the opposite tendency: its ratio of oil reserves to oil production had a declining trend in 1986-2005 and hence its gross savings have been growing (see Fig. 9 in Appendix). If we compare change in the ratio of oil reserves to oil production and change in gross savings in 1980 and 2005, it will be equal to 34% decrease and 22% increase correspondingly. Norway had increase in the ratio of oil reserves to oil production from 21,6 to 26 in 1986 due to discovery of new reserves and by 20% decrease in gross savings. In 2003 gross savings declined sharply and ratio of oil reserves to oil production declined negligibly fluctuating around the level of 10 since 1996. Recently in 2004-06 gross savings increased again despite increase in oil prices as Norway follow quite conservative strategy of saving oil revenues.

Looking at Nigeria it had positive interdependence between ratio of oil reserves to oil production and gross savings while Mexico had significant decline in the ratio of oil reserves to oil production and sufficiently stable gross savings (see See Fig. 9 in Appendix). The ratio has sharply declined for Mexico on 84% comparing the levels of 2006 and 1980 as oil reserves were hardly exploited and it takes time to develop new oilfields. For Nigeria it is the opposite –the ratio increased on 126% comparing the levels of 2006 and 1980⁵⁴. Nigerian gross savings fluctuated a lot and quite sharply: they reached their bottom several times - in 1993-95 and were equal to 11% of GDP, in 1998 and were equal to 12% of GDP and in 2002 again and were equal to 15% of GDP; since 2002 they have started to increase reaching 34% of GDP in 2006. Mexican gross savings experienced negligible increase as a reaction to the oil price increase in 1973-74 and 1979 and 2003-04 and larger decrease in 1986. On the whole Mexican gross savings didn't change radically fluctuating around 20% of GDP for last 36 years.

Making a conclusion about relation between gross savings and real spending rate it can be pointed out that Saudi Arabia and Norway had negative relation while Nigeria had positive one and Mexican gross savings didn't seem to be influenced by the real spending rate. Hence we see that each country has its own pattern influenced by country's individual

⁵⁴ If we compare 2006 and 1970 the ratio of oil reserves to oil production increased only on 3,6% (see Fig. 10 in Appendix).

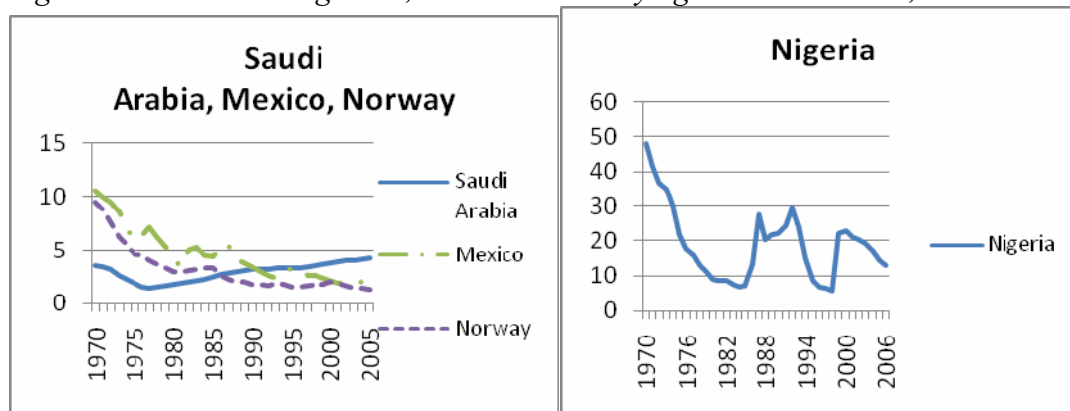
characteristics. Despite the common trend to spend oil revenues for Saudi Arabia, Nigeria and Mexico, the degree and the quality of that spending were different. Moreover Saudi Arabia started to make savings abroad much earlier than Nigeria and Mexico which is one of the reasons why Nigeria and Mexico are much poorer than Norway and Saudi Arabia nowadays. So following the safe strategy gave the same relation between gross savings and real spending rate for Norway and Saudi Arabia.

4.2.2 Exchange regimes and national currency

Another explanation for changing the spending pattern under the last oil price shock is that oil price increase coincided with a sharp fall in the dollar, reducing the external purchasing power of the currencies of those oil exporters that pegged to the dollar⁵⁵. Among these four countries only Saudi Arabia has fixed exchange rate which has been pegged to the dollar since 1987 in order to avoid the Dutch Disease. Nigeria and Mexico have managed floating regimes and now only Norway has purely floating regime which was not always like that. Floating regime helps to mitigate appearing Dutch Disease by mitigating inflation and real exchange rate appreciation.

If we look at Fig. 4.3 we will find that three countries except Saudi Arabia had real appreciation of the national currencies during the first two shocks in 1970s. In 1975-76 Saudi Arabia experienced slight depreciation. Under the third considered shock in 1986 appreciation of Saudis, Nigerian and Mexican currency changed by its depreciation; only Norwegian krone continued to appreciate. Since 2003 Norwegian currency became even stronger as whenever as well as Nigerian and Mexican currency.

Figure 4.3. Real exchange rate, national currency against U.S. Dollar, 1970 – 2006



Source: www.worldbank.org

⁵⁵ Setser (2007)

4.2.3 Inflation

If we look at the inflation the country which was hit mostly was Mexico (Fig. 11 in Appendix). The level of inflation in Nigeria was also very high. Only Saudi Arabia had significantly lower level of inflation in comparison with Mexico and Nigeria. Moreover since 1978 it was basically lower than U.S. inflation. Saudi inflation experienced rises in 1973-74 and 1979-80 as well as Mexican and Nigerian ones. In 1984-87 Saudi Arabia had deflation with its strongest decline in 1986 which was equal to -3,2%. That was completely opposite to Mexican case in 1986. In 2003 inflation level was highest in Nigeria and equal to 14% whereas in Mexico it was equal to 4,5% and in Saudi Arabia 0,6%. Most analysts think that the index of prices used to calculate the official inflation rate in Nigeria and Saudi Arabia is underweight services and overweight goods and consequently understates actual inflation⁵⁶. Nigeria and Saudi Arabia have been subsidizing the fuel prices; besides, they are open to import of goods – in particular, import of food in Nigeria and import of labour in Saudi Arabia. So measure of inflation gives too small weight to services that is why inflation seems to be underestimated in Nigeria and Saudi Arabia.

Norwegian inflation followed the pattern of other three countries having insignificant increase in 1973-74 and larger increase in 1979-80. In 1985-86 in contrast to Saudi Arabia and Nigeria which had decline, Norway had a small increase from 5,7% to 7% whereas Mexican level of inflation was enormous that time and inflation increased from 57,7% to 86%. In 2003 Norwegian level of inflation was equal to 2,5%.

4.2.4 Current account balance

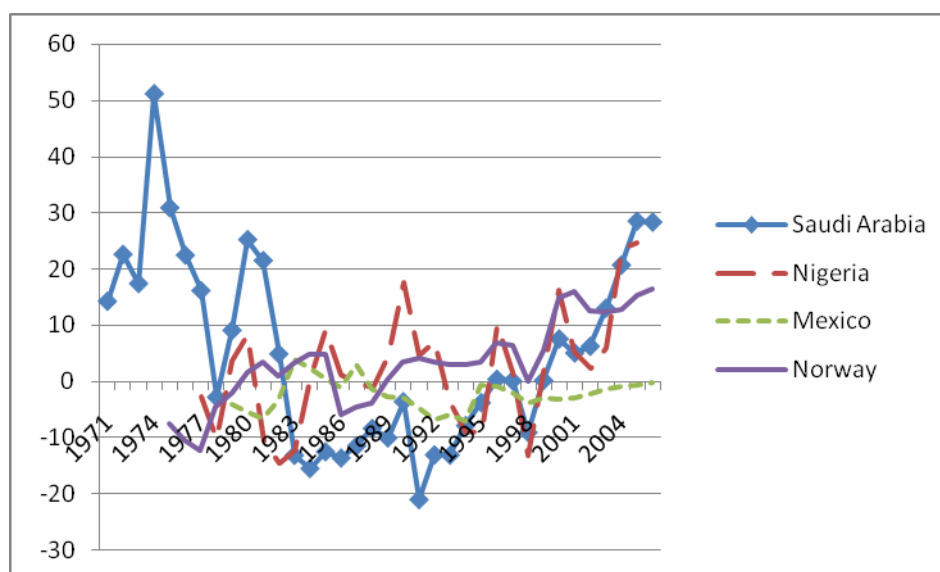
Another indicator of the country's level which helps to understand if a country spends or saves money is current account balance. So looking at Fig. 4.4 we see that in 1978 all four countries had current deficit, the deepest one was for Nigeria. However when the oil price went up in 1980 only Mexican government was left with current account deficit; other countries had significantly improved their current account balances. But if we compare change in average current account before and after shock in 1977-78 and 1981-82⁵⁷ (see Fig.

⁵⁶ Setser (2007)

⁵⁷ Data for Mexican current account balance is available just from 1979 so the comparison is made only for Saudi Arabia, Nigeria and Norway.

4.5), we will see that increase in current account⁵⁸ for Norway was more than 10% of GDP despite its huge deficit at the starting point partly due to oil investments which was exceed by current account surplus in 1981-82 due to intensive oil production. Meanwhile Saudis increase in current account was 6,5% of GDP and Nigeria had even decrease equal to 6% of GDP. Hence it means that Norway and Saudi Arabia were saving part of the money while Nigeria accelerated consumption of oil revenues. First of all Nigeria had salaries increase though productivity hadn't been higher. Moreover new investments projects in education, industry and agriculture continued to be carried out especially in steel, irrigation and fertilizer production. Government tried to support capital-intensive industries and agriculture where two-thirds of the workforce were employed⁵⁹. But only inefficient allocations of investments were made aimed at large farms. Already in early 1980s Nigeria became dependent on food import as export of its agricultural products decreased significantly after appreciating Nigerian currency.

Figure 4.4. Current account balance , % of GDP, 1971-2006

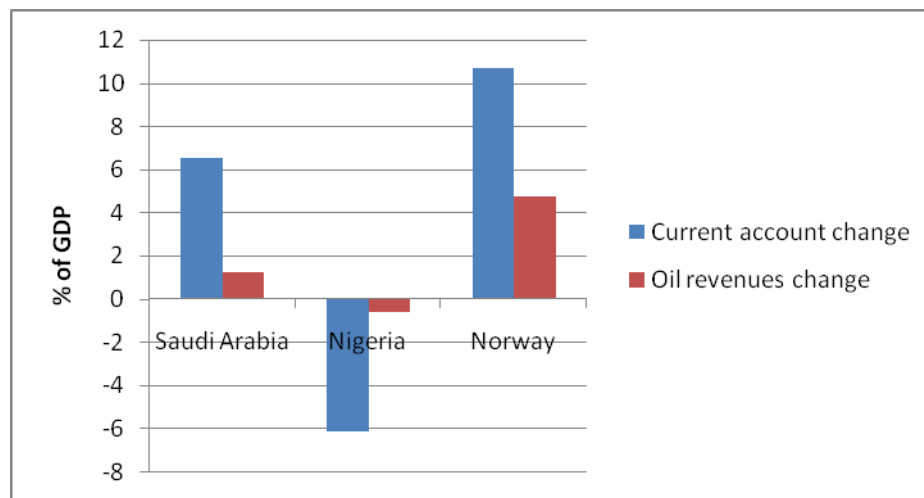


Source: www.worldbank.org

⁵⁸ It is worth noting that many factors besides oil prices will affect current account.

⁵⁹ Auty (1990)

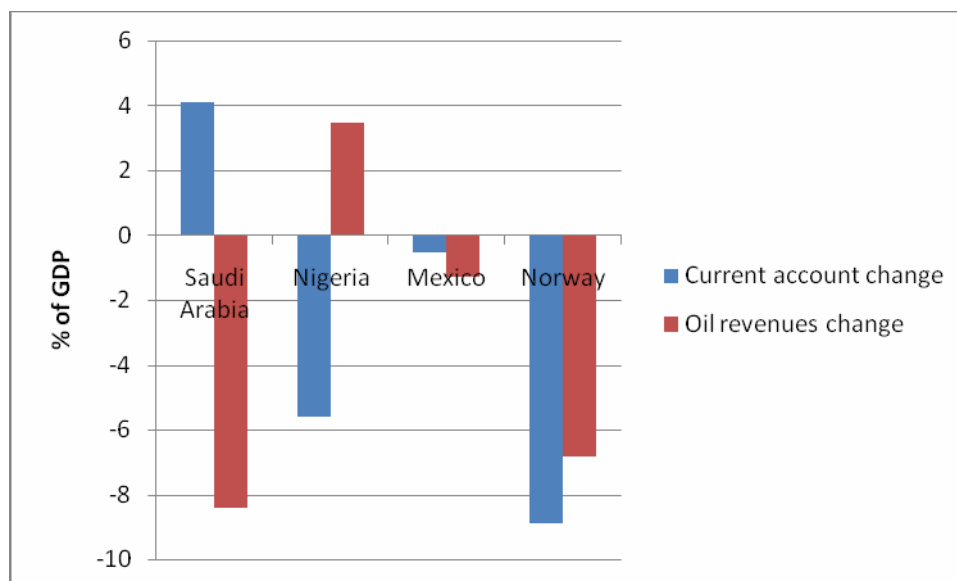
*Figure 4.5. Change in average current account balance at the time of the oil price shock
1979-80, % of GDP*



Source: www.worldbank.org

If we look at the average current account change around the negative shock in 1986 (Fig. 4.6) it becomes clear that Mexico and Norway increased their spending. Despite increase in oil revenues Nigeria continued its spending instead of saving. Saudi Arabia had significant decrease in oil revenues and finally it changed its strategy taking into account its permanent deficit and started saving—current account change was positive and was equal to over 4% of GDP.

*Figure 4.6 .Change in average current account balance at the time of the oil price shock
1986 (% of GDP)*

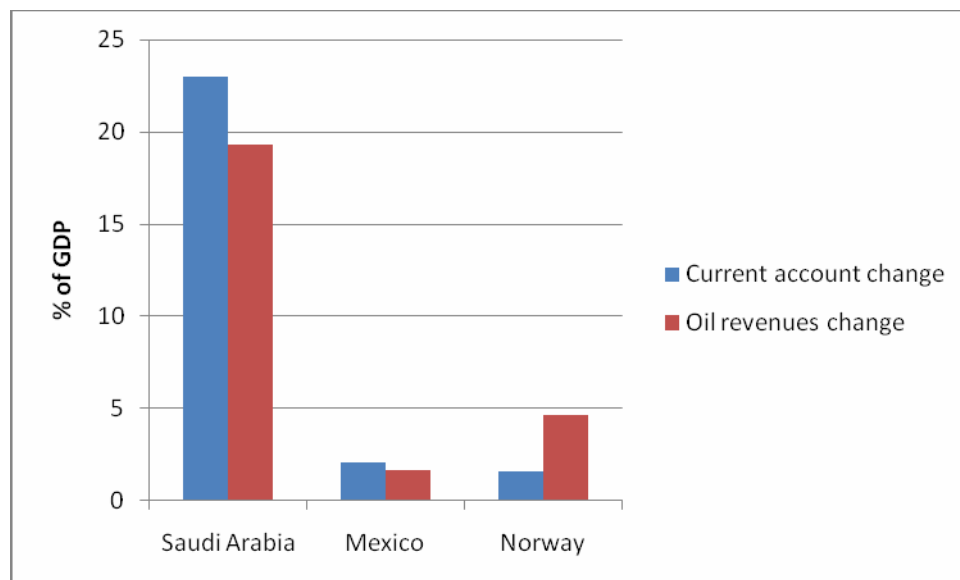


Source: www.worldbank.org

The next oil price shock is recent increase in oil prices in 2003-2004 when oil price reached 38\$ per barrel⁶⁰. This influenced positively growth of oil revenues in Saudi Arabia, Mexico and Norway: they increased on 19,3% of GDP, 1,7% of GDP and 4,63% of GDP correspondingly (see Fig. 8 in Appendix).

As we see on Fig. 4.7 current account had positive change in Saudi Arabia, Mexico and Norway in contrast to 1970s. The highest one was in Saudi Arabia and was equal to 23% of GDP; change in Mexico and Norway was more modest – 2,05% of GDP and 1,6% of GDP correspondingly. Hence such countries as Saudi Arabia and Mexico started to save far more now than in comparison with 1970s and 1980s. Besides they stopped accelerating spending and treating the oil price increase as a permanent positive shock.

Fig. 4.7. Change in average current account balance at the time of the oil price shock 2003-04 (% of GDP)



Source: www.worldbank.org

Saudi Arabia having in mind its financial difficulties in the beginning of 1990s when its foreign assets ran down and its domestic debt ran up has been saving additional oil revenues keeping them in foreign assets. In particular Saudis government spent roughly 1/3 of the oil windfall and used 2/3 to repay debt and increase the kingdom's deposits with the central bank⁶¹. Besides government tries to provide current account surplus which has been

⁶⁰ In this section only Saudi Arabia, Mexico and Norway are discussed because data for Nigerian government finances is available only until 1987.

⁶¹ Setser (2007)

successful since 1999 (Fig. 4.4) . This policy allows the government to defend itself from the volatility of oil revenues and to cover losses in case of oil revenue declines.

Mexico also experienced recession in 1994-1995 and since then up to 2006 it had current account deficit (Fig. 4.4). In 1997-98 when it was the fall in oil prices the strategy of Mexican government was still to increase production in order to cope with the crisis but recently in 2007 David Robinson, Deputy Director of the Western Hemisphere Department, claimed⁶² that oil production will be decreasing over the next five years. He also highlighted the package of public sector reforms that were approved in September 2007 which he believes “will improve the effectiveness and accountability of public expenditure while also securing the tax resources to pay for essential government investments and social expenditures”. Besides current planning is based on a medium-term whereas in 1970s and 1980s it was based on short-term. Furthermore they expect the decline in oil revenues over the next five years and don’t treat oil price shock as permanent. Another innovation is the tax reform that is created to substitute at least partly the loss from future oil production. Moreover the unified national account system will be introduced among states to improve transparency and accountability which was one of the problems under the Dutch Disease. By the way, Nigeria also launched recently the Nigeria Extractive Industries Transparency Initiative to improve its oil revenue transparency.

Summarizing the pattern of current account and oil revenues change we can notice the same pattern as for government finances. In 1970s the reaction was similar, in 1980s countries had their individual patterns of responses and in 2000s changes in both indicators for Saudi Arabia, Mexico and Norway started to approach each other. However the size of these changes is quite different as Saudis oil reserves are incommensurably larger than Norwegian and Mexican.

4.3 Conclusion

The four considered countries represent the four different types of political regimes and different ways of using oil revenues. In 1970s the reaction to the shock was quite similar for

⁶² Transcript of a Conference Call on Mexico's 2007 Article IV Consultation Washington, D.C.
December 13, 2007 www.imf.org

Saudi Arabia, Nigeria and Mexico: oil revenues and government expenditures moved in the same direction. Oppositely Norway didn't rely fully on unexpected oil revenues trying to diversify economy and to support non-traded sectors such as shipping, fishing, tourism etc. After negative shock in 1986 Saudi Arabia changed its strategy of subsidising and spending heavily on infrastructure, transportation and mining. It started to save money in foreign assets, whereas Nigeria and Mexico continued spending and were more and more dependent on oil. All four countries including Norway experienced current account deficits, appreciation of their national currencies and inflation. But the point is that oil revenues helped Norway and partly Saudi Arabia to overcome these economic difficulties but Nigeria and Mexico experienced continuous curse from oil revenues. However the reaction to the oil price shock in 2003 was quite different than to the previous ones: nowadays all the countries have egalitarian values and pursuing long-term or mid-term purposes including stabilisation of economy though Nigeria and Mexico are still struggling with poverty, current account deficit and inflation. Saudi Arabia discovered enormous oil reserves that help it to provide prosperous future. Norway represents the model of using the oil revenues and mature democracy for all these and other countries. However the problem that can arise for Norwegian government is increase in pension payments that will demand increase in spending of oil revenues whereas oil reserves and oil production are small now. So the next step is to solve a new challenge of the population aging that many countries will encounter in XXI century, and to repeat success of the past century.

5. Conclusion

Despite the differences for such large oil countries-exporters as Saudi Arabia, Nigeria, Mexico and Norway in historical, economical and cultural background there could be distinguished some similarities in the reaction to the oil price shocks. The biggest common mistake for Saudi Arabia, Nigeria and Mexico was that the first and second oil price shocks in 1973-74 and 1979-80 were taken as permanent. These countries rushed to accelerate consumption, to invest heavily in domestic manufacturing, to decrease personal taxes and subsidize fuel prices. That resulted in real appreciation of the exchange rate, boosted inflation, current account deficits and outstripped domestic absorption.

Another common feature of Saudi Arabia, Nigeria and Mexico is weakened agricultural sector that actually supposed to be a buffer for the economies when oil revenues would decline. Nigeria, the African country that had bright prospects in 1970s, became dependent on food import already in the beginning of 1980s and still remains such one. The biggest problem for Nigeria and Mexico was that they donated money for large farms that were inefficient and didn't support development of small individual farms. Besides they made more subsidies to urban population and to city infrastructure than to countryside. Moreover real appreciation of the national currencies made their export too expensive at the international market. So agricultural products produced in Nigeria and Mexico became incompatible and the countries came to be dependent on cheap products import that resulted in collapse of agricultural sector.

Next common feature is poverty in 1970s which countries tried to overcome investing money in education and different supportive programs. Now there is lack of education for rural population and women especially in Nigeria and Saudi Arabia.

The 1986 oil price shock led to decrease in government expenditures in Saudi Arabia and Mexico. However Nigeria kept spending its oil revenues. The beginning of 1990s was met by current account deficit in Saudi Arabia and Mexico and in the middle of the decade it was turn of Nigeria.

In 2000s Saudi Arabia, Nigeria and Mexico have been still dependent on the oil and trying to build economy that would be diversified. However the reaction to oil price is quite different than in 1970s and 1980s. Now countries are trying to save money and not to accelerate

spending. Besides they have tighter monetary policy and are trying to have sustainable growth combined with low inflation rate.

Generally speaking Saudi Arabia did a little bit better than Nigeria and Mexico on account of three reasons. Firstly it accumulated financial resources abroad; secondly, as population of Saudi Arabia in comparison with population of Nigeria and Mexico is quite small, there was high influx of foreign workers that helped to absorb excessive money in the economy. And the third reason lies in the Saudis regime which was stable comparing to often changed government of Nigeria and Mexico. Hence there was no need to spend resources right away in order to get the support of electors.

Norway had quite distinctive politics trying to save almost all oil revenues in order to have fair distribution of oil wealth and to build up diversified economy. Besides population had “high level of trust” to government that is why latter didn’t have to spend oil income immediately. Gradually economy became stronger, and saved oil money helped to sustain economy development even during the crisis in the beginning of 1990s.

Nowadays oil reserves declined in Mexico and Norway whereas Saudi Arabia discovered enormous riches. Nigeria has also increase in oil reserves. These tendencies influence spending patterns as well forcing Norway and Mexico to save more now and Saudi Arabia to save less in comparison with 1970s.

As we see there are some common and distinctive features of the behaviour of oil countries-exporters. However each country has its own way to make or to continue making oil richness a “bless” in the XXI century.

References

- Auty R.M. (1990): "Resource-based industrialization: sowing the oil in eight developing countries": Clarendon Press
- Auty R.M. (1994): "Economic development and industrial policy: Korea, Brazil, Mexico, India and China": Mansell
- Auty R.M. (2004): "Resource abundance and economic development": Oxford
- Blanchard and Fischer (1989): "Lectures on macroeconomics": The Mit Press
- Bjerkholt Olav and Offerdal (1985): "Macroeconomic prospects for a small oil exporting country": Martinus Nijhoff Publishers
- Bjerkholt Olav, Olsen Øystein and Voslie Jon (1990): Recent modelling approaches in applied energy economics: Chapman and Hall Ltd
- Cappelen A., Eika T. and Holm I. (2000): "Resource booms: curse or blessing? Effects of oil on the Norwegian Economy 1975-99": Article presented at the annual meeting of the American Economic Association 2000, Mimeo, Statistics Norway Research Department
- Davis Jeffrey, Ossowski Rolando, Daniel James, and Barnett Steven (2001): Stabilization and saving funds for non-renewable resources: experience and fiscal policy implications: Washington, D.C., International Monetary Fund
- Eifert Benn, Gelb Alan, and Nils Borje Tallroth (2003): Managing oil wealth: Finance and Development, Vol. 40, No. 1
- Everhart Stephen and Duval-Hernandez Robert (April 2001): "Management of oil windfalls in Mexico: historical experience and policy options for the future": The World Bank, Policy research working paper 2592
- Ezeala-Harrison (1993): "Structural re-adjustment in Nigeria: Diagnosis of a severe Dutch Disease syndrome": American Journal of Economics and Sociology, Vol. 52, No. 2, pp. 193-208
- Fidel Ezeala-Harrison (April 1993): Structural re-adjustment in Nigeria: diagnosis of a severe Dutch disease syndrome: The American Journal of Economics and Sociology
- Gylfason Thorvaldur (August 2001): "Lessons from the Dutch Disease: causes, treatment, and cures": Institute of Economic Studies. Working paper series
- Gylfason Thorvaldur and Zoega Gylfi (February 2002): "Natural resources and economic growth: the role of investment": Central Bank of Chile, Working papers, No. 142
- Hannesson Rögnvaldur (1998): "Petroleum economics: issues and strategies of oil and natural gas production": QUORUM books Wesport
- Hannesson Rögnvaldur (2001): "Investing for sustainability: The Management of Mineral wealth": Kulwer Academic Publishers

Hilaire Natalie St. (December 2004): “Dutch Disease, Oil and Developing countries”: University of Alberta, Canada

Humphreys Macartan, Sachs Jeffrey D., and Stiglitz Joseph E. (2007): “Escaping the resource curse”: Columbia University Press

Kajander Thomas (2007): “The resource curse and economic growth: A study of four different regions”: Norges Handelshøyskole

Kjaer Knut N. (March 2008): “Challenges in the management of the Norwegian oil wealth”: Presentation for the Department of Economics, University of Oslo

Larsen Erling Røed (May 2004): “Escaping the resource curse and the Dutch Disease?”: Statistics Norway, Research Department, Discussion papers No. 337

Looney Robert E. (1992): “Real or illusory growth in an oil-based economy: government expenditures and private sector investment in Saudi Arabia”: World Development, Vol. 20, No. 9, pp.1367-1375

Lopez Ramon and Toman Michael A. (2007): “Economic Development and Environmental Sustainability: new policy options”: Oxford University Press

Obstfeld Maurice and Rogoff Kenneth (1996): “Foundations of International Macroeconomics”: The MIT Press Cambridge

Ross Michael L. (May 2003): “Nigeria’s Oil Sector and the Poor”: Report for the UK department for International Development “Nigeria: drivers of Change” program

Sachs Jeffrey D. and Stiglitz Joseph E. (editors) (2007): “Escaping the resource curse”: Columbia University Press

Schatz Sayre P. (March 1984): “Pirate capitalism and the inert economy of Nigeria”: The Journal of Modern African Studies, Vol. 22, No. 1, pp. 45-47

Setser Brad (March 2007): “Oil and global adjustment”: Peterson Institute for International Economics (www.iie.com)

Watts (2006): “Empire of oil: capitalist dispossession and the scramble for Africa”: Monthly Review, Vol. 58, No. 4.

World Bank (May 2007): “Avoiding the resource curse”: Petroleum sector briefing note No.3

World Bank Debt Statistics (1988)

A briefing of Jubilee Debt Campaign, Action Aid International Nigeria, Christian Aid, new economics foundation, Oxfam GB, and World Development Movement (February 2006): “Justice for Nigeria: why the UK should return to Nigeria’s £1,7 billion to fight poverty” http://www.oxfam.org.uk/resources/policy/debt_aid/downloads/justice_nigeria.pdf

BP Statistical Review of World Energy (June 2007)

“Transcript of a Conference Call on Mexico's 2007” (2007): Article IV, Consultation
Washington, D.C. (www.imf.org)

Banco de Mexico <http://www.banxico.org.mx>

British Petroleum <http://www.bp.com>

Energy Information Administration (Official Energy Statistics from the U.S. Government)
<http://www.eia.doe.gov>

International Monetary Fund <http://www.imf.org>

Nigeria's National Bureau of Statistics <http://www.nigerianstat.gov.ng>

Norges Bank <http://www.norges-bank.no>

Organisation of the Petroleum Exporting Countries <http://www.opec.org>

Saudi Arabian Monetary Agency <http://www.sama.gov.sa>

Organisation for Economic Co-operation and Development <http://www.sourceoecd.com>

Statistics Norway (Statistisk Sentralbyrå) <http://www.ssb.no>

U.S. Department of the Treasury, Bureau of the Public Debt <http://www.treasurydirect.gov>

World Bank <http://www.worldbank.org>

Appendix

Table 1. Oil proved reserves, thousand millions barrels

Year	Mexico	Norway	Saudi Arabia	Nigeria
1980	47,2	3,6	168,0	16,7
1981	57,0	3,9	167,9	16,5
1982	57,0	3,8	165,5	16,8
1983	57,1	3,8	168,8	16,6
1984	56,4	4,9	171,7	16,7
1985	55,6	5,6	171,5	16,6
1986	54,9	6,1	169,7	16,1
1987	54,1	6,6	169,6	16,0
1988	53,0	7,3	255,0	16,0
1989	52,0	7,6	260,1	16,0
1990	51,3	8,3	260,3	17,1
1991	50,9	8,8	260,9	20,0
1992	51,2	9,7	261,2	21,0
1993	50,8	9,5	261,4	21,0
1994	49,8	9,6	261,4	21,0
1995	48,8	10,8	261,5	20,8
1996	48,5	11,6	261,4	20,8
1997	47,8	12,0	261,5	20,8
1998	21,6	11,6	261,5	22,5
1999	21,5	10,9	262,8	29,0
2000	20,2	11,3	262,8	29,0
2001	18,8	11,6	262,7	31,5
2002	17,2	10,4	262,8	34,3
2003	16,0	10,1	262,7	35,3
2004	14,8	9,7	264,3	35,9
2005	13,7	9,6	264,2	36,2
2006	12,9	8,5	264,3	36,2

Source: www.bp.com

Table 2. Oil production, thousand barrels daily

Year	Mexico	Norway	Saudi Arabia	Nigeria
1980	2129	528	10270	2059
1981	2553	512	10256	1440
1982	3001	532	6961	1290
1983	2930	661	4951	1236
1984	2942	752	4534	1388
1985	2912	823	3601	1499
1986	2758	907	5208	1467
1987	2879	1054	4599	1353
1988	2877	1196	5720	1496
1989	2897	1567	5635	1775

1990	2977	1716	7105	1870
1991	3126	1955	8820	1960
1992	3120	2217	9098	2020
1993	3132	2377	8962	2024
1994	3142	2693	9084	1991
1995	3065	2903	9145	1998
1996	3277	3232	9299	2145
1997	3410	3280	9482	2316
1998	3499	3138	9502	2167
1999	3343	3139	8853	2066
2000	3450	3346	9491	2155
2001	3560	3418	9209	2274
2002	3585	3333	8928	2103
2003	3789	3264	10164	2263
2004	3824	3188	10638	2502
2005	3760	2969	11114	2580
2006	3683	2778	10859	2474

Source: www.bp.com

Table 3. Planned financial allocations for Saudi Arabia, 1970-1990 Five-Year Plans (%)

Plan	(1) 1970-75	(2) 1975-80	(3) 1980-85	(4) 1985-90 ⁶³	(5) 1987 Revision
Development					
Economic Resources	6,5	18,5	32,8	13,1	5,0
Human Resources	17,9	16,1	16,7	13,5	14,0
Social	4,7	6,6	7,1	8,9	6,5
Physical Infrastructure	29,2	22,7	33,3	14,4	2,5
Total	58,3	63,9	89,9	49,9	28,0
Other					
Administration	18,7	7,6	5,3	n/a	6,0
Defence	23,1	15,7	n/a	n/a	35,7
Miscellaneous	-	12,7	4,8	n/a	30,3
Total	41,8	36,0	10,1	50,1	72,0

Source: *Auty (1990)*

Table 4. Production structure by sectors for Saudi Arabia (% of GDP), 1970-2006

	1970-72	1973-74	1979-81	1986-87	1994-96	2003-06
Agriculture	3,66	1,56	1,07	5,32	5,85	3,69
Manufacturing	7,43	5,19	4,67	8,45	9,62	9,94
Services	28,94	20,39	29,78	55,70	44,74	45,55

Source: www.worldbank.org

⁶³ Total allocated: (1) US \$9,2 billion, (2) US \$141,7 billion, (3) US \$222,0 billion, (4) US \$227,0 billion.

Table 5. Production structure by sectors for Nigeria (% of GDP), 1973-1999

	1973-74	1979-81	1986-87	1994-96	1998-99
Agriculture	23,24	20,54	40,66	1,99	1,60
Manufacturing	3,25	6,06	9,67	0,39	0,23
Services	0,40	0,21	0,28	0,015	0,01

Source: www.worldbank.org

Table 6. Production structure by sectors for Mexico (% of GDP), 1970-2006

	1970-72	1973-74	1979-81	1986-87	1994-96	2003-06
Agriculture	12,29	12,09	9,27	9,99	5,97	3,88
Manufacturing	23,07	22,84	22,30	25,58	20,34	17,96
Services	56,16	56,11	57,31	53,56	66,36	69,93

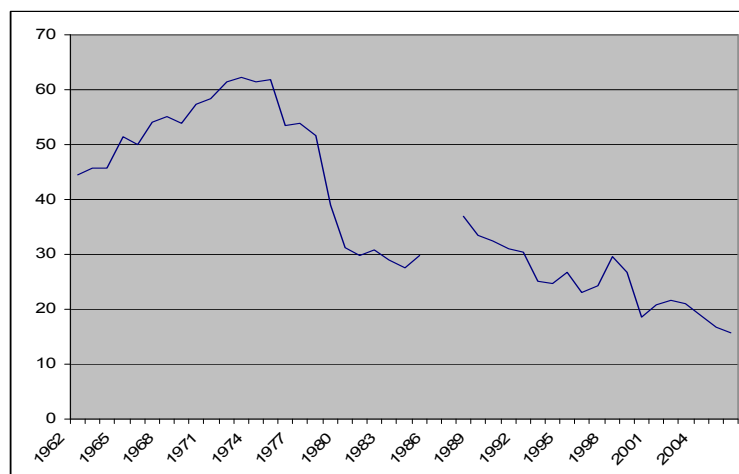
Source: www.worldbank.org

Table 7. Production structure by sectors for Norway (% of GDP), 1970-2006

	1970-72	1973-74	1979-81	1986-87	1994-96	2003-06
Agriculture	5,64	5,12	4,18	3,74	2,91	1,58
Manufacturing	20,77	21,37	16,19	14,17	12,72	9,95
Services	63,08	63,15	57,37	62,04	62,48	57,05

Source: www.worldbank.org

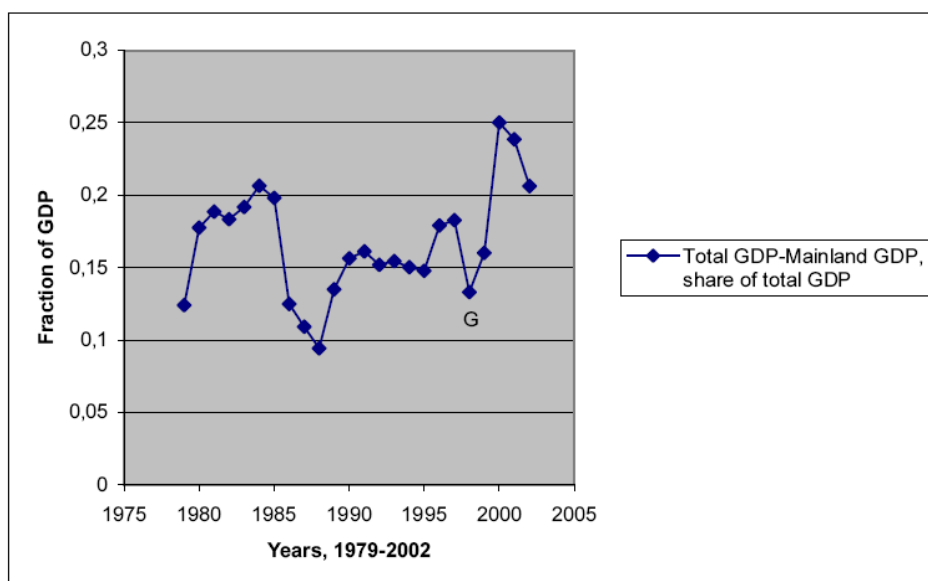
Figure 1. Manufactures exports (% of merchandise exports)⁶⁴



Source: www.worldbank.org

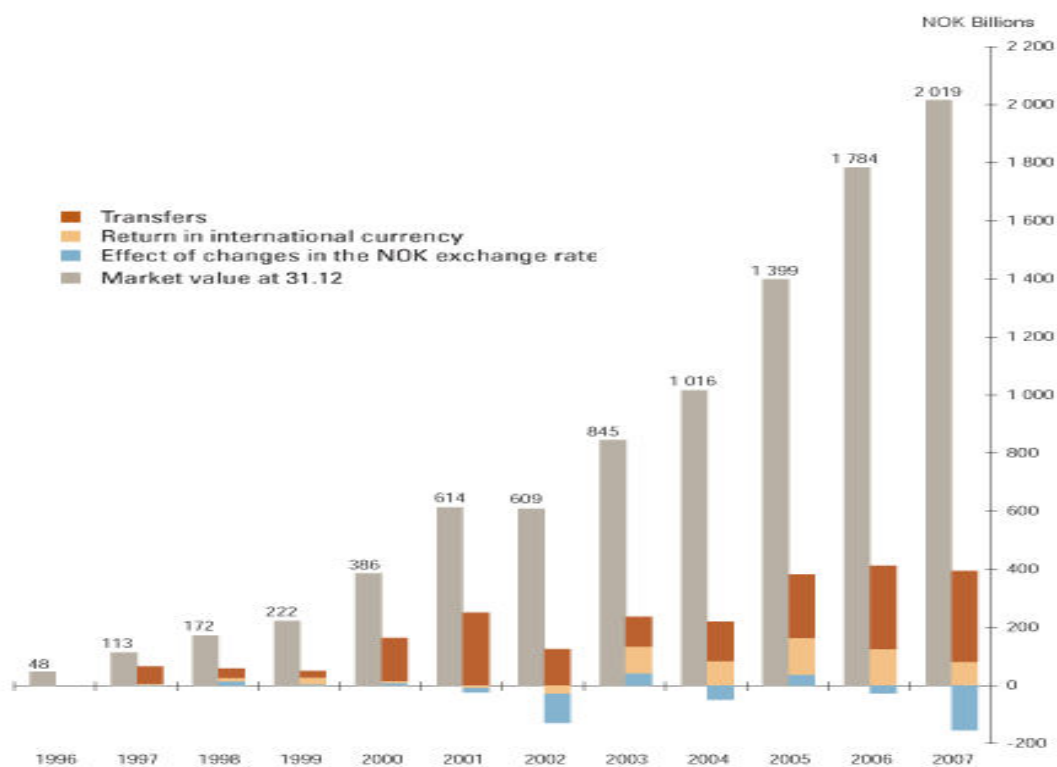
⁶⁴ The data is absent for 1987-88.

Figure 2. The importance of North Sea Oil and Gas, Fraction of GDP, Market Value, 1979-2002



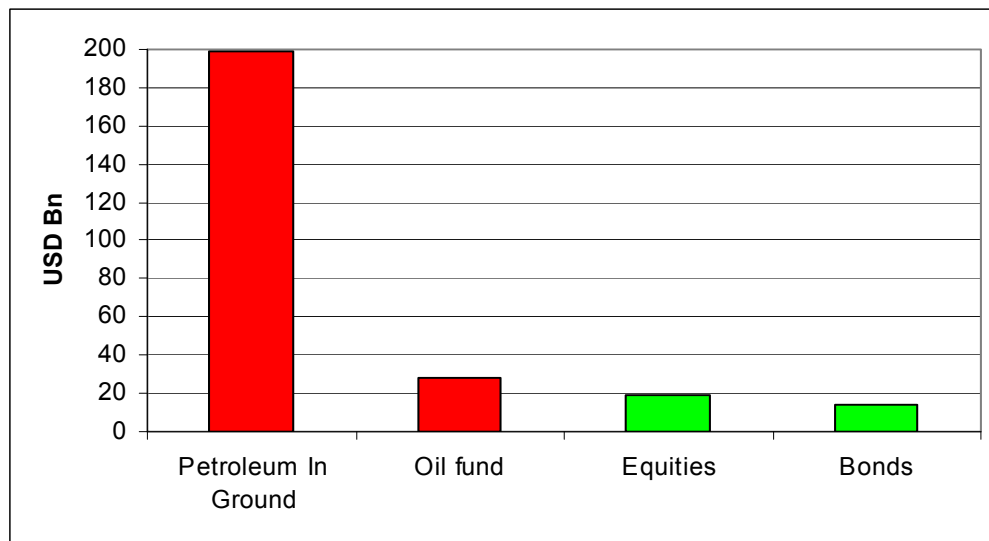
Source: www.ssb.no

Figure 3. The Government Petroleum Fund



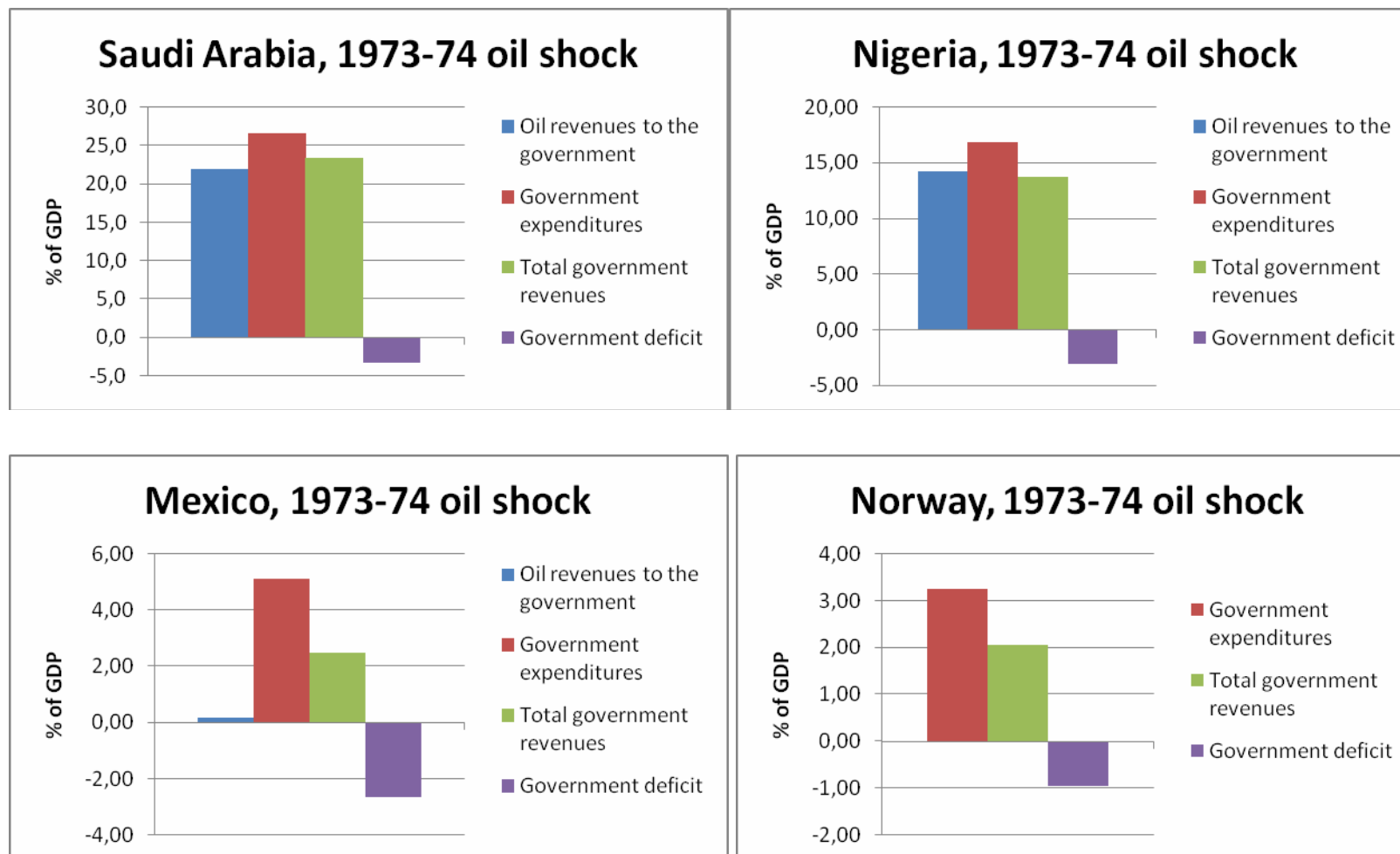
Source: www.norges-bank.org

Figure 4. Diversification of the government's wealth, 2006



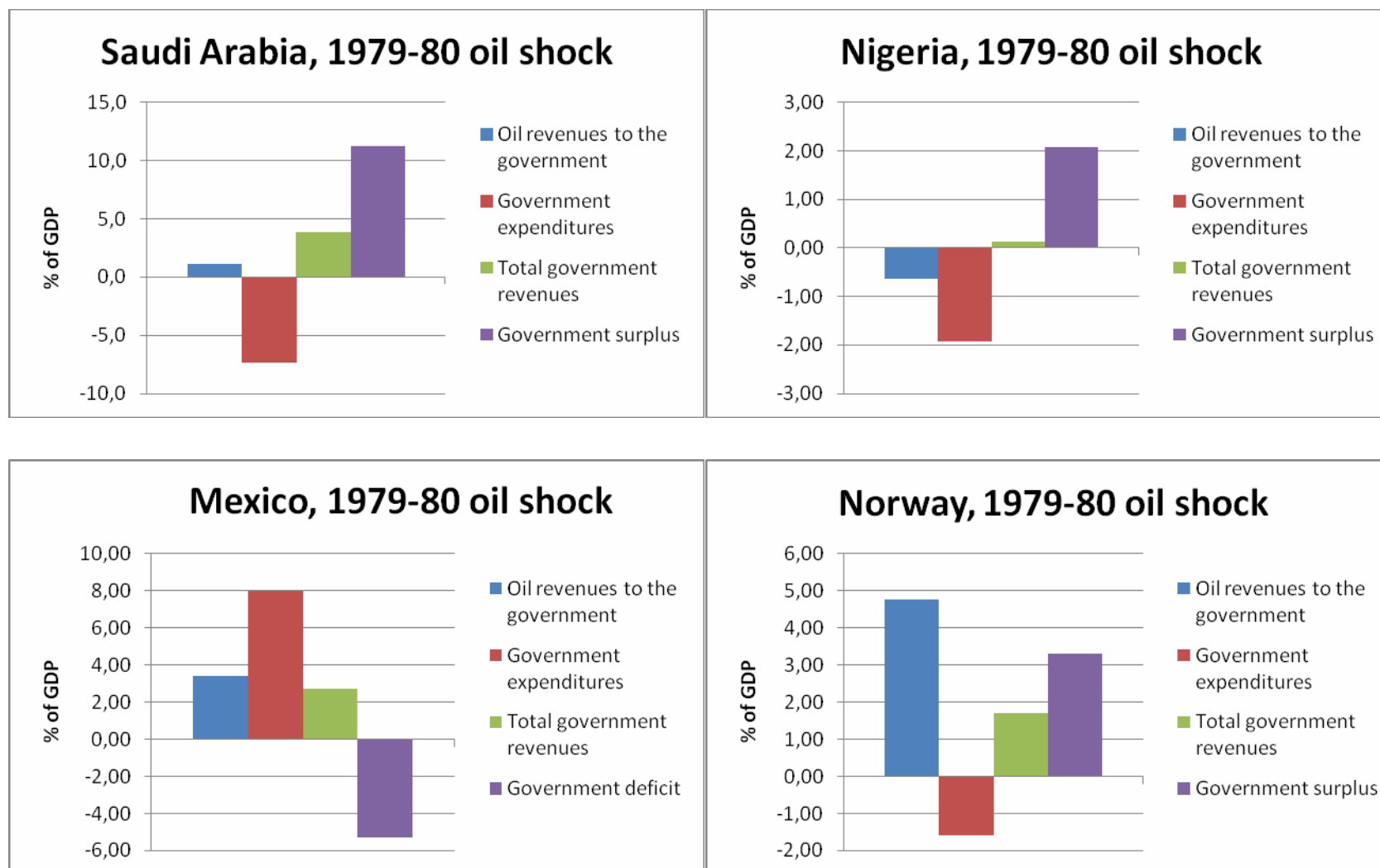
Source: Norges Bank Investment Management

Figure 5. Change in government finances around the oil shock in 1973-74



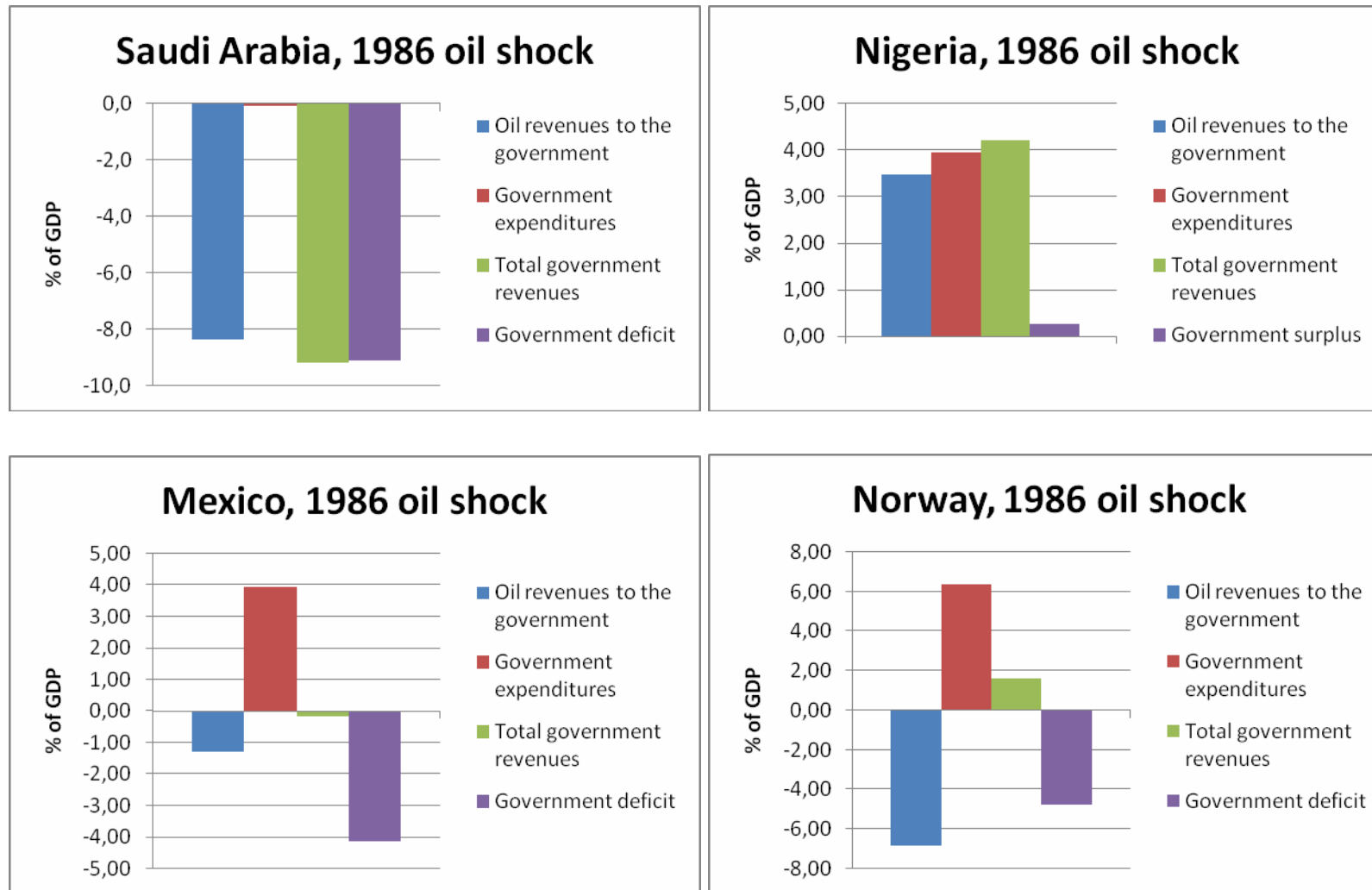
Source: www.sama.gov.sa, www.nigerianstat.gov.ng, www.banxico.org.mx, www.ssb.no

Figure 6. Change in government finances around the oil shock in 1979-80



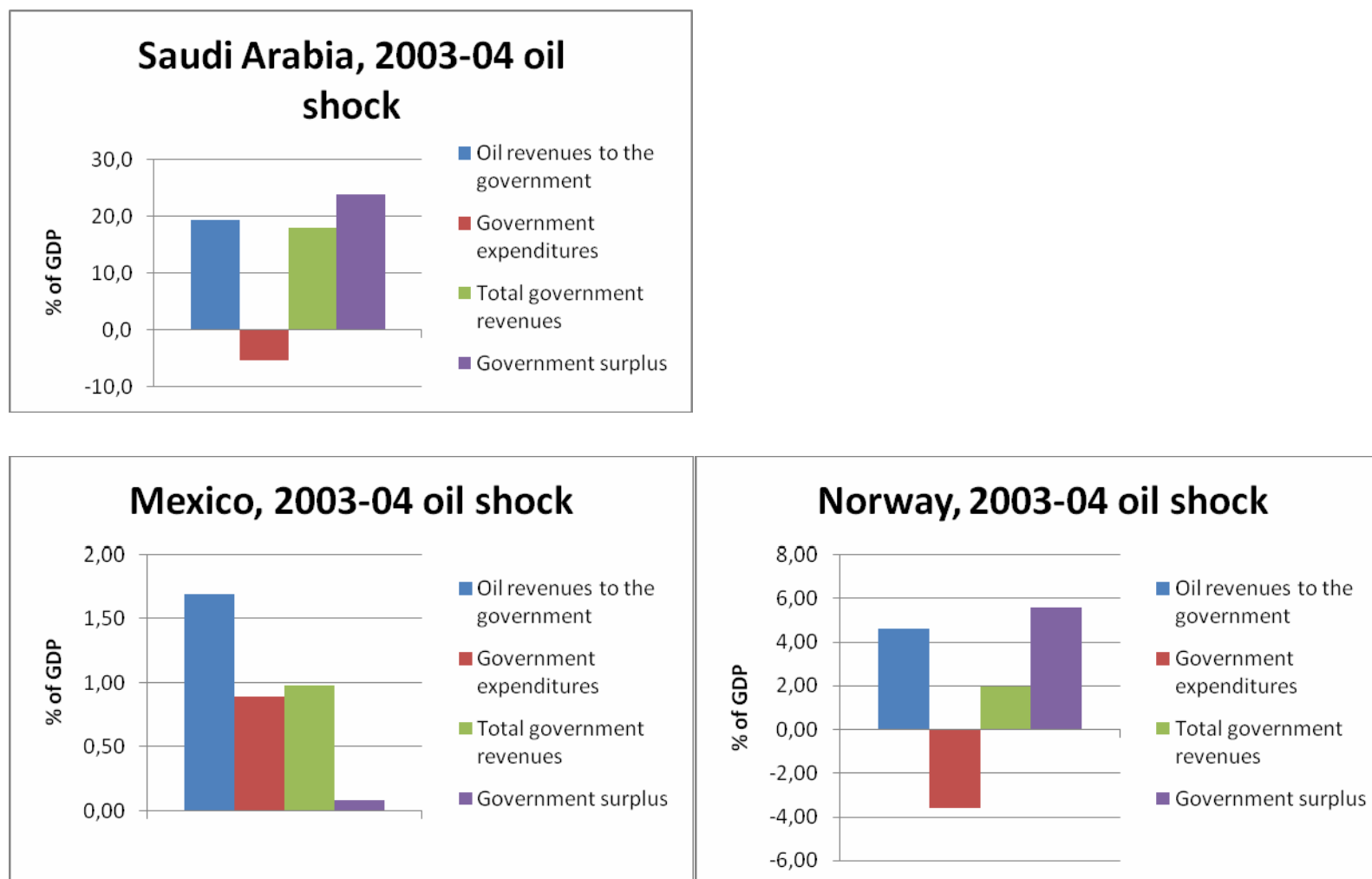
Source: www.sama.gov.sa, www.nigerianstat.gov.ng, www.banxico.org.mx, www.ssb.no

Figure 7. Change in government finances around the oil shock in 1986



Source: www.sama.gov.sa, www.nigerianstat.gov.ng, www.banxico.org.mx, www.ssb.no

Figure 8. Change in government finances around the oil shock in 2003-04



Source: www.sama.gov.sa, www.nigerianstat.gov.ng, www.banxico.org.mx, www.ssb.no

Figure 9. Gross savings (% of GDP) and the ratio of oil reserves to oil production, 1970 - 2006

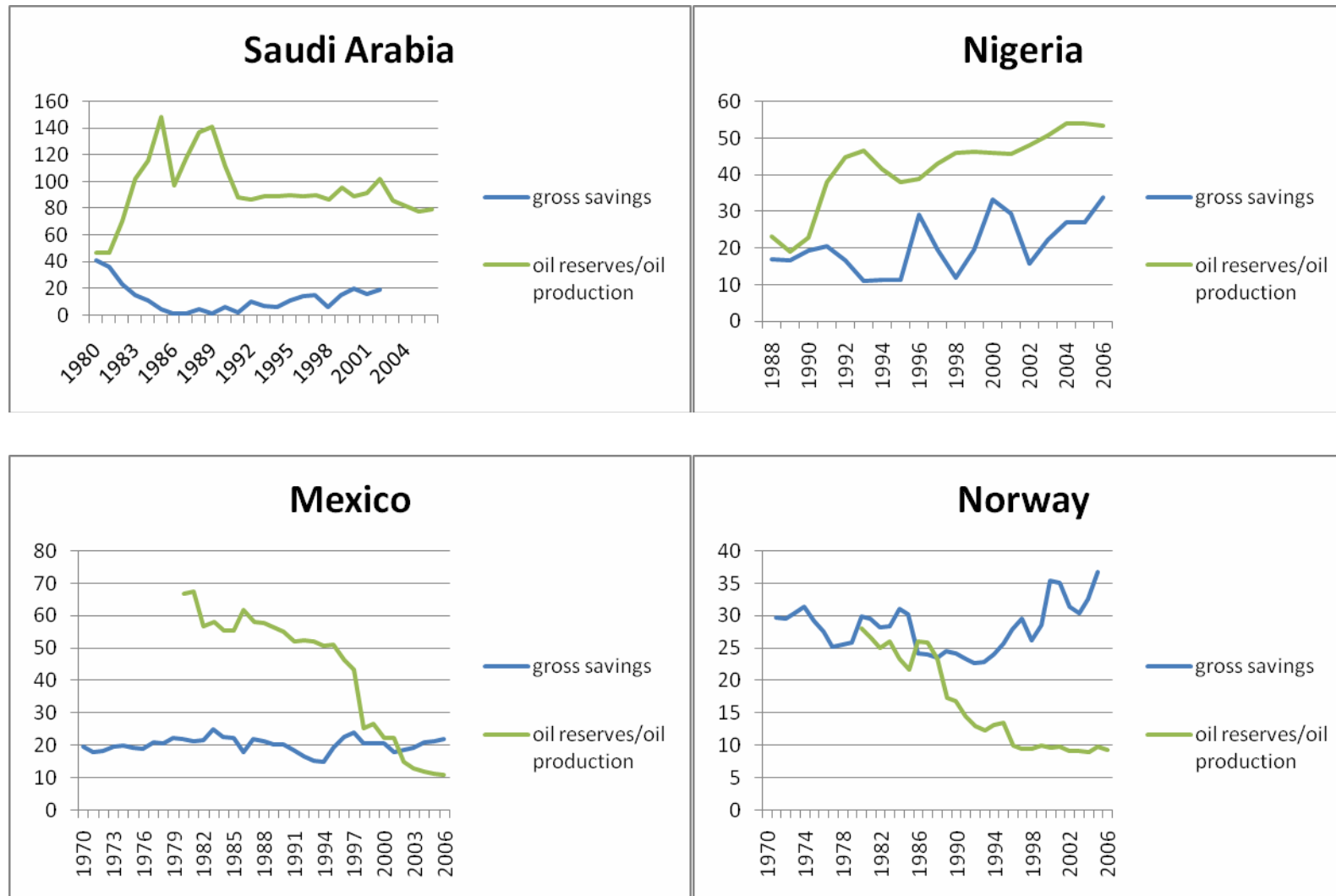
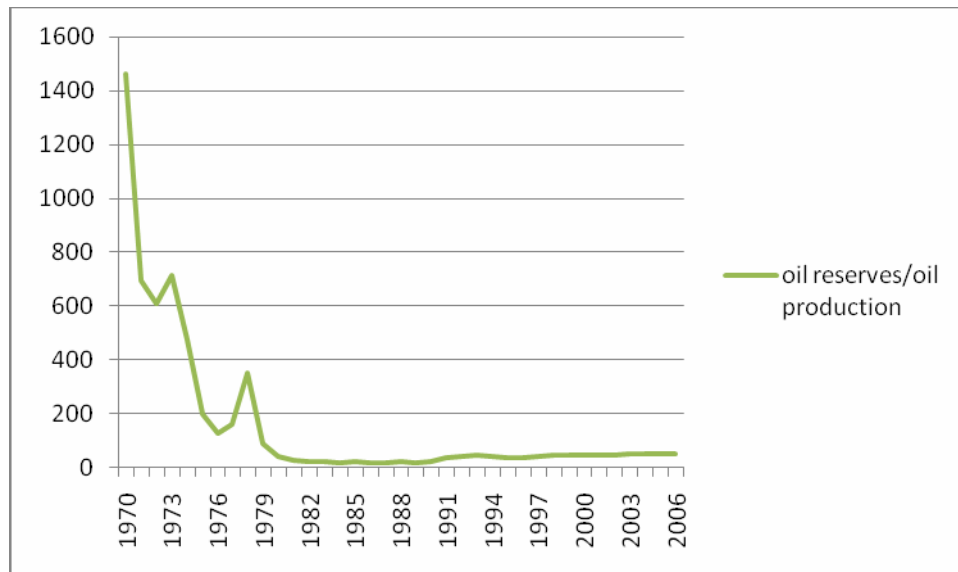
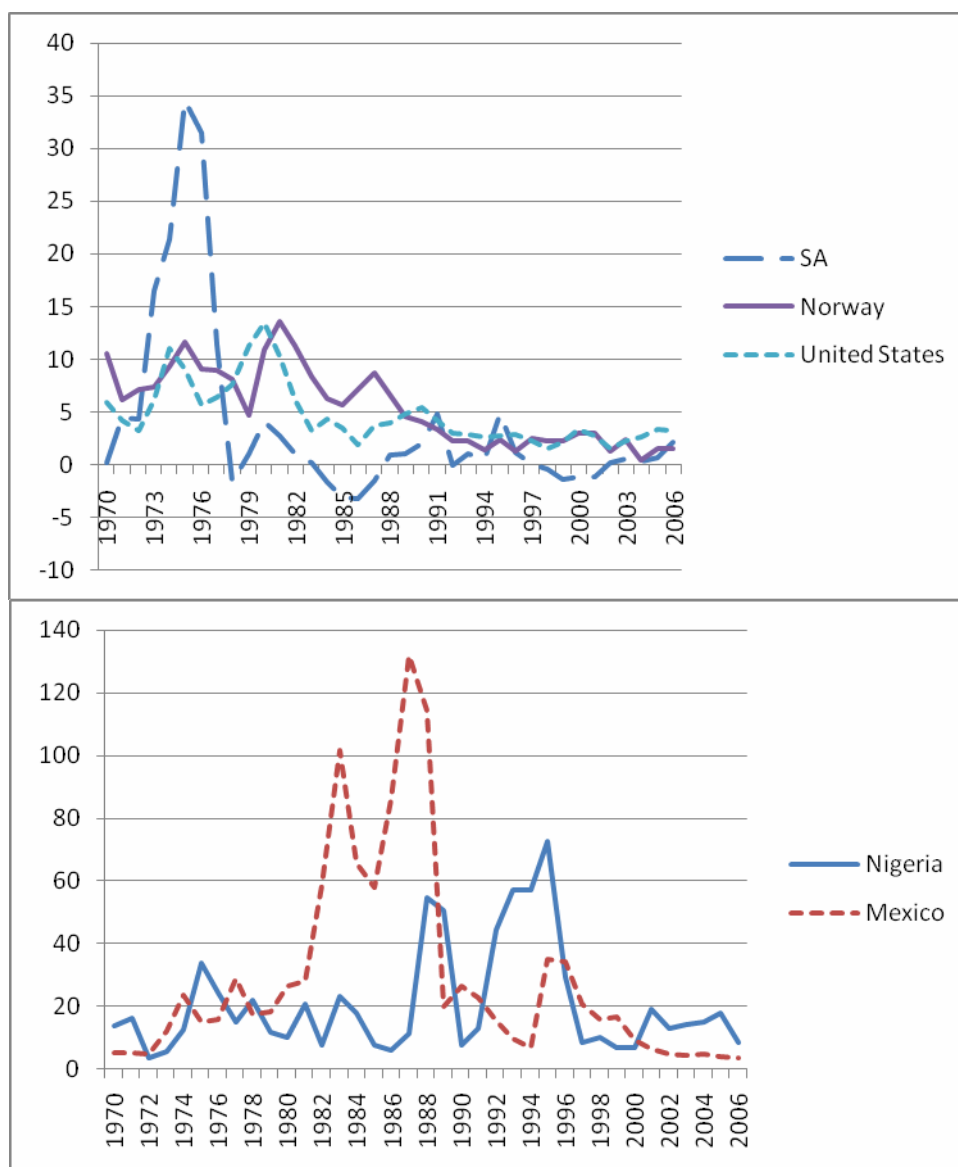


Figure 10. Ratio of oil reserves to oil production for Nigeria, 1970 – 2006



Source: www.opec.org

Figure 11. Inflation, consumer prices (annual %), 1970 – 2006



Source: www.worldbank.org